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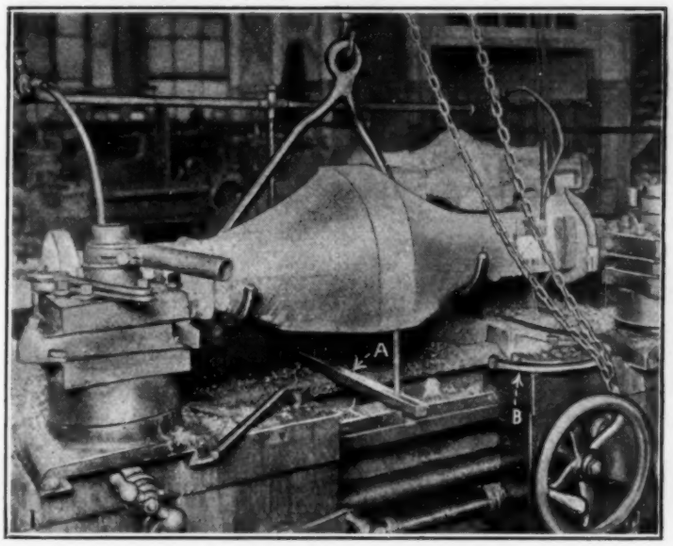


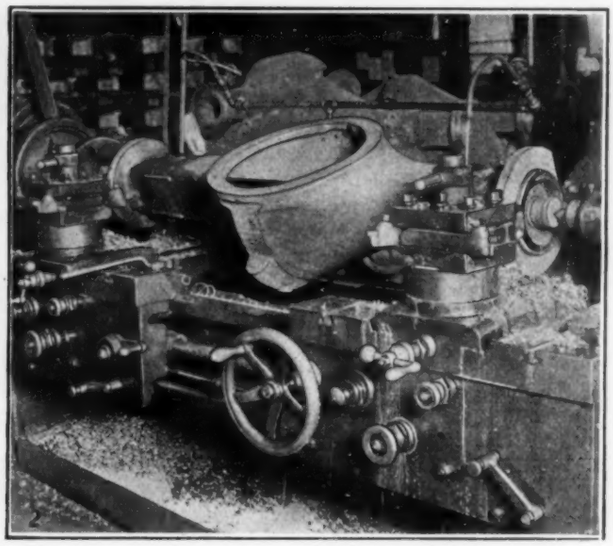


FIG. 1—HANDLING THE HOUSING INTO THE LATHE. FIG. 2—TURNING BOTH FLANGES AT ONCE

Building the Housings for the Sheldon Truck Axle

By FRED H. COLVIN
Editor, *American Machinist*

First of a series showing the sequence of operations and the methods used in making heavy duty axles—Machines, fixtures, tools and inspection practice

IN MANY ways the product of the Sheldon Axle Co., Wilkes-Barre, Pa., is a typical example of the advancement in transportation methods. Organized many years ago to make axles for horse drawn vehicles, the plant has developed into one devoted almost entirely to building rear axles for motor trucks of various sizes, although a small portion of the plant still turns out axles for horse drawn vehicles. A peculiar phase of this feature of the business is that the latter department continues its activities, and shows signs of the elimination of the horse.

Beginning with a large size axle housing for trucks carrying 5 tons, we find a steel casting weighing on the average, 392 lb. These castings are purchased from an outside foundry and are first inspected thoroughly before going to the machining department. Here the first operation is to turn the flanges on both ends simultaneously in the lathe shown in Figs. 1 and 2. The lathe has two carriages and it has been found advisable to use two operators on the work. This obviates the necessity of using a helper and greatly decreases the time required for machining. In Fig. 1, the housing is just being lowered into position by means of the double hook attached to a chain hoist.

The axle is held on a mandrel having a cone at each end. These cones have three high spots, or ribs, for centering the rough casting. One cone is fixed to the mandrel while the other is removable, being held in place against the casting by means of a large nut.

In order to be sure that the mandrel is correctly centered in the axle housing, the housing is lowered into position in the lathe with the carrier face down, as shown in Fig. 1. The gage *A*, consisting of a square bar and two uprights, is placed across the ways of the lathe and the position of the castings tested by the two pins shown. Should the face prove to be too high or too low, the housing is removed from the lathe and the mandrel adjusted by placing metal strips, or shims.

between the contact points of the cones and the housing. This adjusting is very seldom necessary as the castings come very true to pattern. Also shown in Fig. 1, at *B*, are the snap gages used in measuring the two diameters turned on the ends.

The turning operation itself is shown in Fig. 2, tools in both posts being at work simultaneously. This view also shows the general construction of the housing, the carrier face and the way in which a portion of each flange is cut away to accommodate the brake rigging.

After the turning, the axles pass a ten per cent inspection and go to the Ingersoll milling machine, shown in Fig. 3. The first operation here is to mill the carrier seat and the spring pads at each end, at one setting. The cutters on the central spindles machine the carrier seat and those on the end, the spring pads. There is also shown the type of fixtures used for holding the housings by the ends that have just been turned. The housings are located by means of the gage *A*, which tests the parallelism of the carrier-face with the milling machine table.

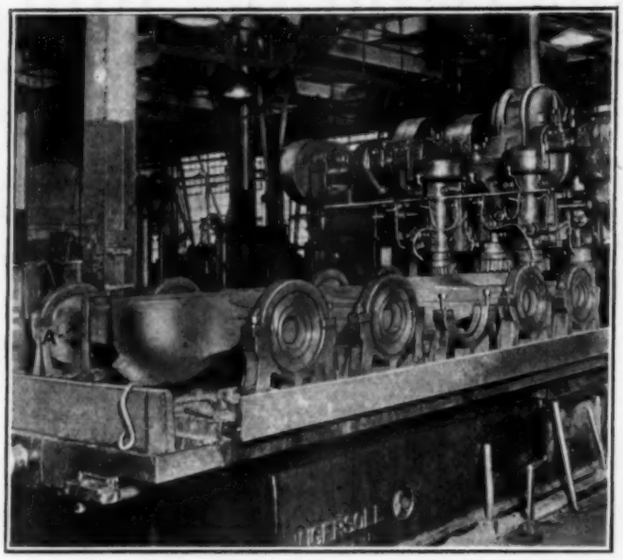


FIG. 3—MILLING CARRIER-SEAT AND SPRING-PADS

Changing the cutters on the two inner spindles for ones of smaller diameter provides for the next operation, the milling of the two bracket seats, and the three other sides of the spring pads near the ends. The practice is to run a lot of housings through for the first milling operation, handling the housings in preference to changing and setting the milling cutters. This method enables a ten per cent inspection to be made between the two milling operations.

After the cutters have been changed, the remainder of the milling is done without removing the axles from the fixtures. The clamps are simply loosened and the housings turned over so as to present the other spring pad surfaces for milling.

The method of squaring the axle housings after milling the first spring pads is to use locating blocks having tongues and grooves on their inclined surfaces, which make it easy to secure any height adjustment within their range, and at the same time keep the upper and lower surfaces parallel.

The flanges on the ends of the housing are drilled, while the housing is held on a turntable fixture, as shown in Fig. 4. The table carries locating blocks and screw clamps as shown at *A*, while the end pieces *B* and *C* form the bushing plates for guiding the drills. The flanges are held by the clamps shown. This drilling arrangement is mounted on an old lathe which is provided with a special, multiple-spindle drilling head *D*, driven from the lathe spindle. It will be noted that a special cone pulley has been provided so as to allow a wide driving belt on the steps most used. The indexing of the turntable and the work is controlled by the lever *E*.

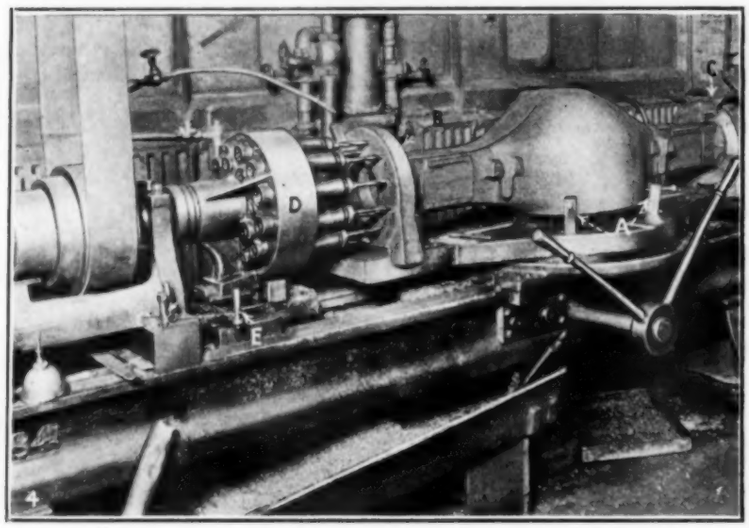
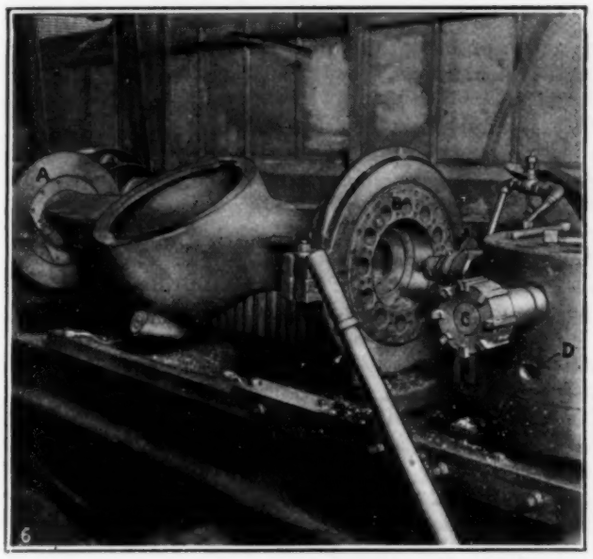


FIG. 4—DRILLING END FLANGES. FIG. 5—MACHINE FOR BACK-FACING FLANGE HOLES

After the holes are drilled, they are back faced on the machine shown in Fig. 5. The housing flange rests in the support at *A* and is indexed by the plug *B*, which fits in the drilled holes. The back facing is done by the cutter *C*, which is mounted in the adjustable head shown. This enables it to be adjusted to accommodate both circles of different diameters, and a sliding-key drive allows the facing cutter to be moved into the work by means of the lever *D*. The facing cutter carries a pilot which centers in the drilled holes.

The ends of the housing are next bored on the lathe shown in Fig. 6, which has been especially rigged up for this work. The housing is centered on the face plate *A*, by its flange, which fits into the recess shown, and is driven by pins fitting some of the drilled holes



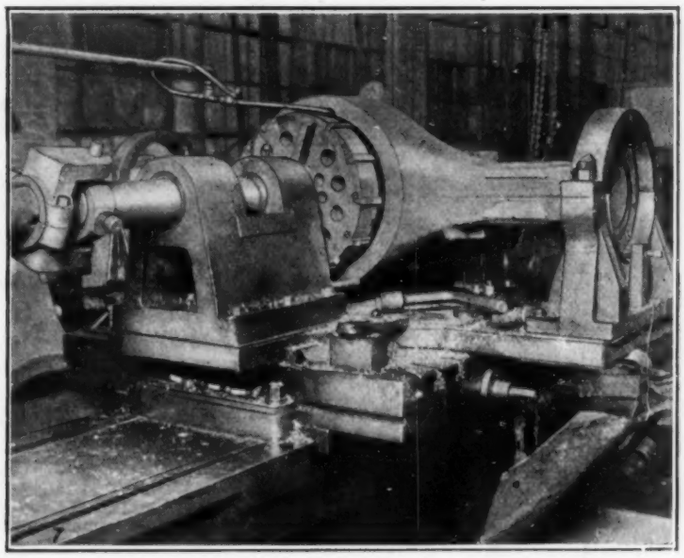


FIG. 6—BORING END OF HOUSING. FIG. 7—BORING HOUSING FOR CARRIER

The outer end is supported in the carrier *B*, which revolves with it, running in the special steadyrest provided for this purpose. The hole is first roughed out with a flat cutter in a boring bar and finished with the cutter shown at *C*. The turrett is indexed on its periphery, one of the holes being shown at *D*.

Boring a 17-in. Hole

After another ten per cent inspection, the carrier hole is bored on the fixture shown in Fig. 7, which is mounted on an old boring machine of the movable-table type. This boring cutter is 17 in. in diameter and is supported on a heavy spindle, running in a substantial head. The housing is held by the flanges at each end in a fixture very similar to those used in the milling operations. The carrier is squared by its large face and the boring cutter is driven by the floating joint shown at the left.

Drilling for brackets and other connections is performed in special fixtures which locate the holes with reference to the flanges at the ends of the housing. All that remains to be done is the drilling of a few other holes, the tapping of those which are necessary, and the burring, after which a one hundred per cent inspection is made before the housings go to the assembling department.

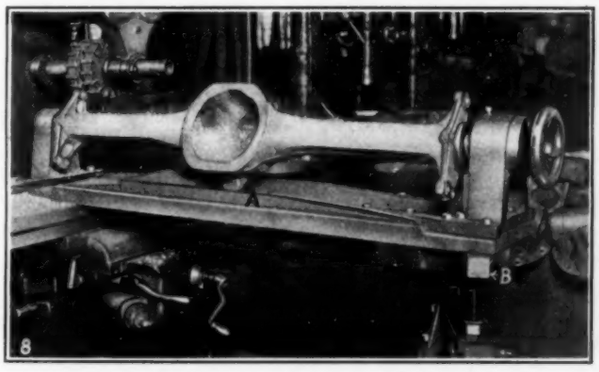
As many of the operations on the housings of different sizes are very similar, only three are shown for the machining of the small size axle. Both ends are first bored and faced and the bearing surfaces hand reamed. The carrier seat and brackets and pads are milled and then the housing comes to the special fixture. shown in Fig. 8. It consists of a substantial base *A*, having two uprights. The outer end of the fixture is supported on the square bar *B*, which is adjustable by means of the screws shown, the screws being mounted on a shop horse made for this purpose.

In this operation both sides of the brake-carrying spider are milled by the large straddle mills shown, on the Milwaukee milling machine. The housing is swung into two positions, one for each arm of the spider and is then turned end for end and the other spider milled in the same way. The feed of the milling machine table slides the outer end of the fixture on the supporting bar *B*. These housings weigh but 100 lb. each in the rough and are, therefore, handled with ease.

Drilling the End Holes

The end holes are drilled in another turntable fixture, Fig. 9, of a design modified from that shown in Fig. 4. It is mounted on an engine lathe and a smaller special multi-spindle drilling head having a ball thrust is provided for drilling all the holes at once. The different sizes of drills used will be seen at the left.

The fixture for drilling the carrier seat is shown in Fig. 10. The bushing plate is separate from its support, as can be seen at *A*, and is located by the pins *B*. The brackets *C* and *D* carry spring-pad bushings for



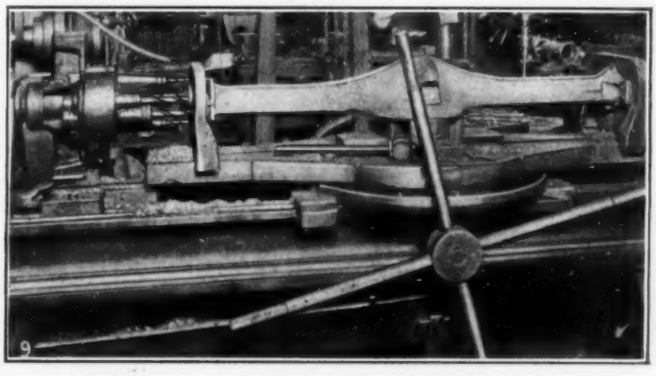


FIG. 8—MILLING BRAKE SPIDERS ON SMALL AXLE. FIG. 9—DRILLING BRAKE SPIDERS

an axle of a somewhat different type which is handled in this same fixture.

The remaining holes are then drilled and spot faced, the ends of the spiders are split for clamping, the holes

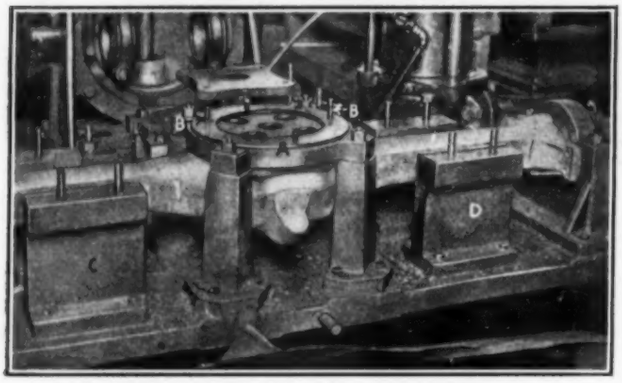


FIG. 10—DRILLING CARRIER SEATS ON SMALL AXLES

for the carrier studs, brackets and brake clamps are tapped and any chipping and burring which may be necessary, is done. After a careful inspection of each housing it is ready to go to the assembling department. Here, in some cases, it receives a few additional operations before taking its place in a completed axle.

Teach Your Boy a Trade—Discussion

By Robert D. Harper

The articles that have appeared on page 872, Vol. 58 and page 392, Vol. 59 of the *American Machinist*, under the above title apparently ignore a very important side of the question, i.e., why boys of good parentage do not wish to learn trades.

When we consider that a boy spends eight years in an elementary school, where the majority of teachers do not look with favor on their bright students learning a trade or doing manual work for a living, it is not hard to understand the dislike of these boys for trade work. One has only to think back to one's elementary school graduating class and recall the voice of the teacher asking how many are going to enter high school. She makes the appeal as strong as possible because (in a good many instances) her rating depends on the number she sends to high school. She does not tell us that a classical high school course without a college career would help very little in earning a living. Nor does she tell us that the country can absorb only 10 per cent of the population in professional activities, or that if all who entered high school, finished a professional course, they would have slim chances of employment. She implied that bright American boys could do nothing else.

Society Does Not Appreciate Mechanics

Naturally, nearly all of the boys, in good localities at least, went to high school. Here they came in contact with bookish men and women, and intentionally or not, they absorbed the idea, that working with the hands was only for the newly arrived immigrant. Brain work is the only occupation for a gentleman. Even if a boy were mechanically inclined, he would hesitate to learn a trade when he graduated, for to him it would have meant a loss of social prestige and standing, which means a lot to a boy 16 to 18 years of age. If he had to go to work, he took a position in a store, office or bank, and in time began to look down upon the mechanic. He prided himself that he was above them.

Unfortunately, his family is likely to agree with him in this attitude. They forget that in this country the social level is reached by the economic ladder, and that as the income of the various trades continue to increase, their plane will soon be above that of the clerical worker. The great white collar class is to a great extent the result of this false pride, although, no doubt, there will always be those who believe in letting their heads save their hands even at an economic loss.

It would seem that the elementary schools should really teach the dignity of labor and recommend those boys who are mechanically inclined to learn a trade, even though they are bright American boys. They should teach that the boy who earns his living by the use of his hands needs a trained mind, and that he can be as cultured as a boy in a clerical occupation. Early impressions are hard to overcome, so the attitude of the schools toward manual labor will have to change before boys of good parentage will consider learning a trade.

A Perpetual Appraisal System of Value

By William R. Basset

President of Miller, Franklin, Basset & Co., Inc., New York City

The perpetual inventory of raw and finished stock is now almost universally accepted as essential to the close executive control of any manufacturing business.

The perpetual inventory, or appraisal, of equipment is an almost equally valuable aid to the management, although it has not yet been widely adopted. A physical appraisal, because it is expensive to make, is a comparatively infrequent happening in most concerns. In the four to ten years between appraisals, great changes take place in value and location of the equipment, which, unless reflected in the manufacturing costs and in the income tax returns, may have serious affects upon the profits.

The best way to gather overhead is by departments. Each department's overhead includes a round sum for depreciation on equipment. If a machine is moved from one department to another, changes in the overhead to reflect that change should be made. Too often it is not. In a concern operating under a cumbersome bookkeeping system, I once saw depreciation charged on an expensive machine for years after the machine had been sold for scrap. In the same plant, one department carried the same amount of depreciation charges after additions had been made which doubled the amount of equipment in that department.

An excellent perpetual appraisal record consists of one card or loose-leaf sheet for each machine. These records can be grouped by departments. On the card is recorded the first cost, the freight, the cost of installing, the cost of major repairs, the depreciation rate and amount, and the present value. If the machine is moved to another department, that fact is noted on the card, and the card is transferred in the file to the new department.

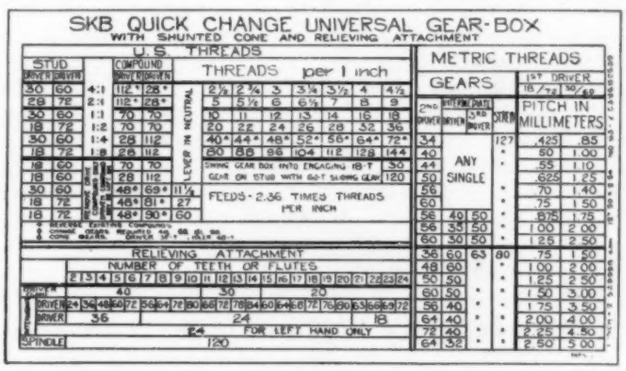
There you have a complete record of every bit of equipment in the plant, by itself, and not buried with a mass of other figures in some general capacity account. It is easy to operate, and invaluable as a control.

Recent Developments in Precision Bench Tools

By B. A. BEHREND
Consulting Engineer, Boston, Mass.

The screw-cutting bench lathe—Universal quick-change gear box adapted to relieving attachment—Thread milling and taper attachments—A tilting turret—Second article

ONE of the most useful tools, capable of application to almost any conceivable operation that can be performed on a lathe, is the screw cutting bench lathe, designed in its general features like an engine lathe. In our experimental department we use a Rivett lathe with lead screw and longitudinal and cross feeds, which is a very remarkable tool, having great possibilities. We soon found, however, that it was not entirely adaptable to the special work which we wished to do. In the first place, the setting-up for


SKB QUICK CHANGE UNIVERSAL GEAR-BOX
WITH SHUNTED CONE AND RELIEVING ATTACHMENT

U. S. THREADS

STUD DRIVER	STUD DRIVEN	COMPOUND DRIVER	COMPOUND DRIVEN	LEVER IN NEUTRAL	THREADS per 1 inch							
30	60	4:1	112 * 28 *		2½	2¾	3	3½	3½	4	4½	
28	72	2:1	112 * 28 *		5	5½	6	6½	7	8	9	
30	60	1:1	70	70	10	11	12	13	14	16	18	
18	72	1:2	70	70	20	22	24	26	28	32	36	
30	60	1:4	28	112	40 *	44 *	48 *	52 *	56 *	64 *	72 *	
18	72	1:8	28	112	80	88	96	104	112	128	144	
18	60		70	70	SWING GEAR BOX INTO ENGAGING 18 T GEAR ON STUD WITH 60 T SWING GEAR							120
18	60		28	112								
30	60		48 *	68 *	11¼	FEEDS - 2.36 TIMES THREADS PER INCH						
18	72		48 *	81 *	27							
16	72		48 *	90 *	60							

* REVERSE EXISTING COMPOUND GEARS REQUIRED TO GIVE 60 DP. ON STUD 60 T.

RELIEVING ATTACHMENT
NUMBER OF TEETH OR FLUTES
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

WORM		40							30					20									
DRIVE	24	36	48	60	72	36	48	60	72	84	60	66	72	78	84	60	66	72	78	60	66	72	72
DRIVEN	36					24					18					E4 FOR LEFT HAND ONLY							
SPINDLE	120																						

METRIC THREADS

GEARS				1ST DRIVER 18 / 72	2ND DRIVER 60 / 48
2ND DRIVER	1ST DRIVEN	2ND DRIVEN	2ND DRIVER	PITCH IN MILLIMETERS	
34	ANY SINGLE		127	4.25	.85
40			"	.50	1.00
44			"	.55	1.10
50			"	6.25	1.25
56			"	.70	1.40
60			"	.75	1.50
56	40	50	"	6.75	1.75
56	35	50	"	1.00	2.00
60	30	50	"	1.25	2.50
36	60	63	80	.75	1.50
48	60	"	"	1.00	2.00
50	50	"	"	1.25	2.50
60	50	"	"	1.50	3.00
56	40	"	"	1.75	3.50
64	40	"	"	2.00	4.00
72	40	"	"	2.25	4.50
64	32	"	"	2.50	5.00

FIG. 17—TABLE OF GEARS FOR STANDARD AND METRIC THREADS

each number of threads, standard and special, required a good deal of time, and, in the second place, the automatic feed was rarely used, as changing it implied each time a different combination of gears, a task which the operator likes to shirk. He therefore did not use the automatic feed at all, but resorted to hand-feed. To obviate these drawbacks, we devised a gear box, which enabled the cutting of all standard threads without special set-ups, as well as a change of the feeds within a wide range, without making changes in the gears. The problem which we set ourselves was to devise the gear box in such a manner, first, that the smallest number of gears was used between the lead screw and the spindle; scondly, that the gear box could be used for setting up for cutting special threads, and even standard threads, if they were to be cut with especial accuracy, with a minimum of intermediate gears specially cut for the purpose; thirdly, that gears could be set up for cutting metric threads; fourthly, that the gear box could be used for the operation of a universal relieving attachment for relieving cutters with straight and spiral teeth having from two to twenty-four flutes or teeth; fifthly, that the gear box could be used for operating a traverse milling attachment for milling long spiral leads. A further extension of this device has been made to obtain a speed range for the spindle of the lathe from 1/20 r.p.m. to 1,200 revolutions per minute.

It was necessary to depart from the commonly known designs of gear box, as we wished to make the gear box in principle, in such a manner that it could be used, not only on this particular type of a lathe, but also on other lathe beds not equipped with gear boxes. An investigation of the existing gear boxes showed that the range of threads provided by them did not answer our requirements, the size of the gear box becoming prohibitive if all the standard threads were to be included in a box of the design commonly met with.

In Fig. 17 a table is given representing the list of threads that can be cut with the new gear box. The table also contains a list of metric threads that can be

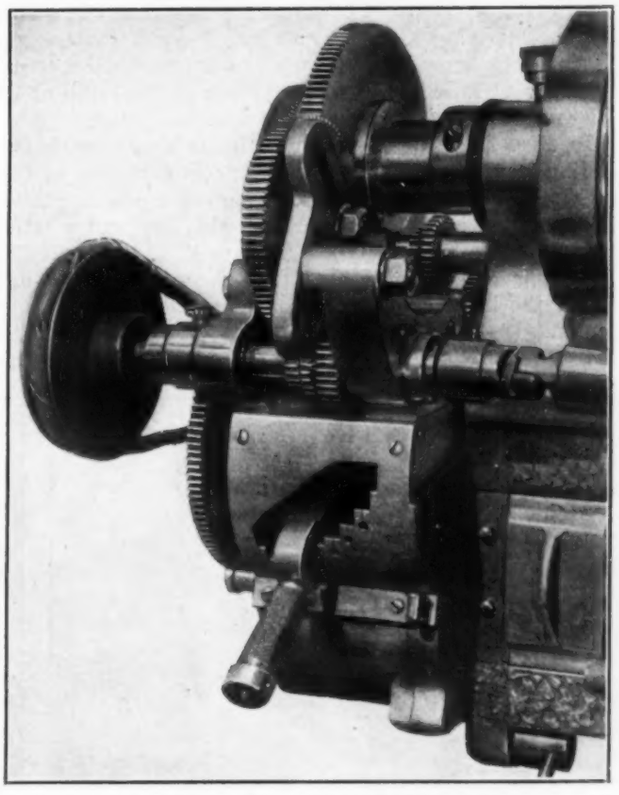


FIG. 18—NEW GEAR BOX (FRONT)

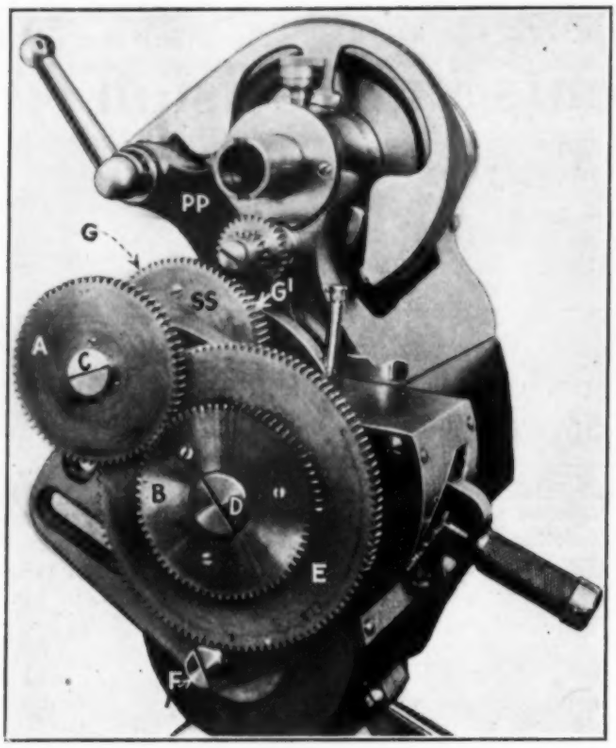


FIG. 19—NEW GEAR BOX (END)

obtained readily by means of special gears, and further there is given a table showing the gears necessary to obtain from two to twenty-four teeth, or flutes, backed off in connection with the use of the universal relieving attachment.

To show somewhat in detail the operation of this gear box there is given in Fig. 18 the front view of the gear box, on top of which are mounted the gears for the relieving attachment. The bracket for the relieving attachment may be permanently set up without in any way interfering with the use of the lathe or of the gear box.

In Fig. 19 the end of the lathe is shown with the sliding gears mounted on the gear box to secure the multipliers of 2, 4, 8, and 16. There is a double pinion *PP* mounted on the stud, and in this particular lathe the stud revolves at twice the speed of the spindle. A sliding gear *SS* engages with the pinion *PP*, so that either the large or small pinion may act as the driving pinion. In Fig. 19 is shown the gear *A* engaging with gear *B*, on which the sliding pinion, attached to the handle of the gear-shifting mechanism is mounted. From shaft *C* to shaft *D* a ratio of one to one or one four can be obtained, as the gear concealed by *A* has 28 teeth and the driven gear has 112 teeth. By adding another set of gears, this ratio of one to four or one to one can be changed to a ratio of four to one. This is done by reversing the gears *A* and the one behind it and gears *B* and *E* and mounting the gears *B* and *E* on shaft *C* and gears *A* and the one behind it on shaft *D*.

As both Figs. 18 and 19 show, the gear box can be turned about the feed rod *F* and locked in position. This makes it possible to bring into mesh the large gear *G* with the large gear of the double pinion *PP* or the gear *G* with the small gear of the double pinion *PP*. Thus, two more combinations can be obtained all through the range of the gear box. This arrangement enables us to cut 30 and 120 threads, which are usually not obtainable in the standard gear boxes except with special set-ups. By properly proportioning the numbers of teeth in the double pinion and the sliding gears meshing with it, a great variety of special threads can be secured.

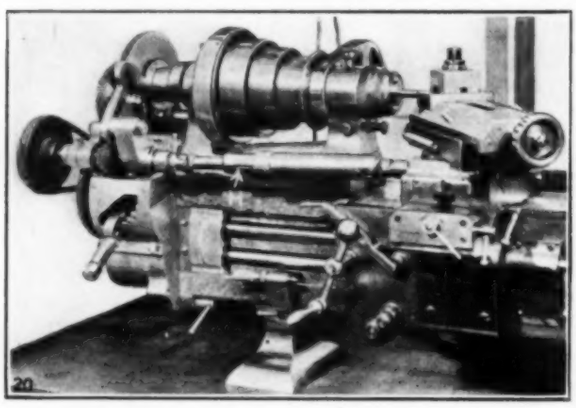
How the Relieving Attachment Is Driven

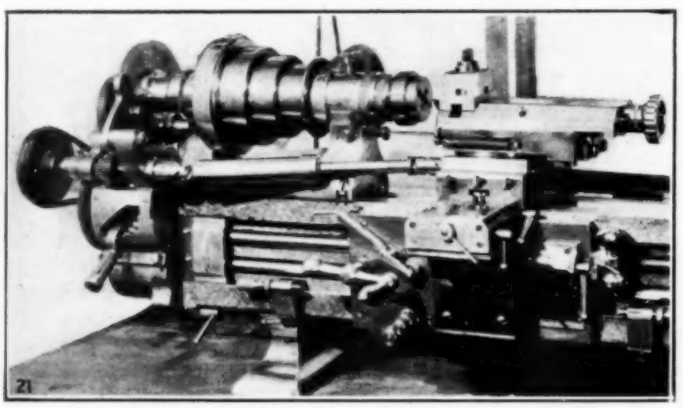
On top of the gear box is mounted a train of reduction gears, which permits the connection of the driving shaft *H* with a universal relieving attachment, as is shown in Figs. 20 and 21. In order to drive this arrangement satisfactorily, it is advisable to change from the cone pulley drive to a pulley mounted directly on the drive shaft for the relieving attachment. As it is arranged in our laboratory, we are using the main drive on the cone pulley and driving through the back gears, and from the back gears through an auxiliary countershaft to the drive shaft of the relieving attachment. This is not shown in the illustrations. Figs. 20 and 21 show the ease with which the relieving attachment can be swung from any angular position to a position parallel with the lathe bed.

The relieving attachment and gear box were executed for our experimental department by the Waltham Machine Works.

The thread dial, shown in Fig. 22, has a range of 3 in. and has mounted on it a bezel which can be turned to one of the main division lines on top of the dial. When screw cutting, the gears in the apron are disconnected by throwing out of mesh one gear in the train.

It has been found useful in our laboratory for quick and moderately accurate screw cutting to use a thread-milling attachment, which is shown in its general set-up





FIGS. 20 AND 21—UNIVERSAL RELIEVING ATTACHMENT AND DRIVE

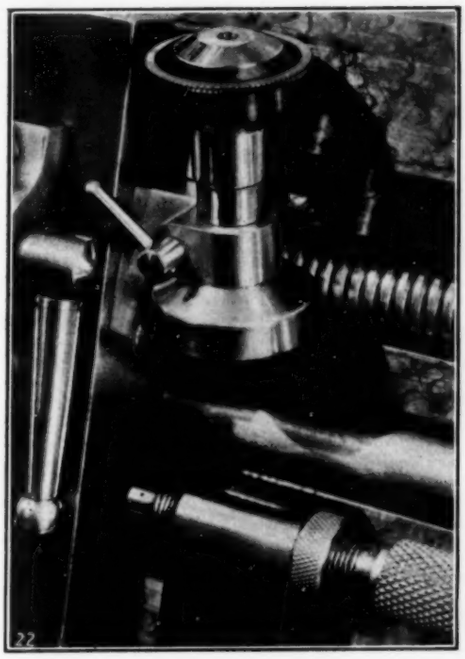


FIG. 22—SCREW CUTTING DIAL WITH ADJUSTABLE BEZEL.

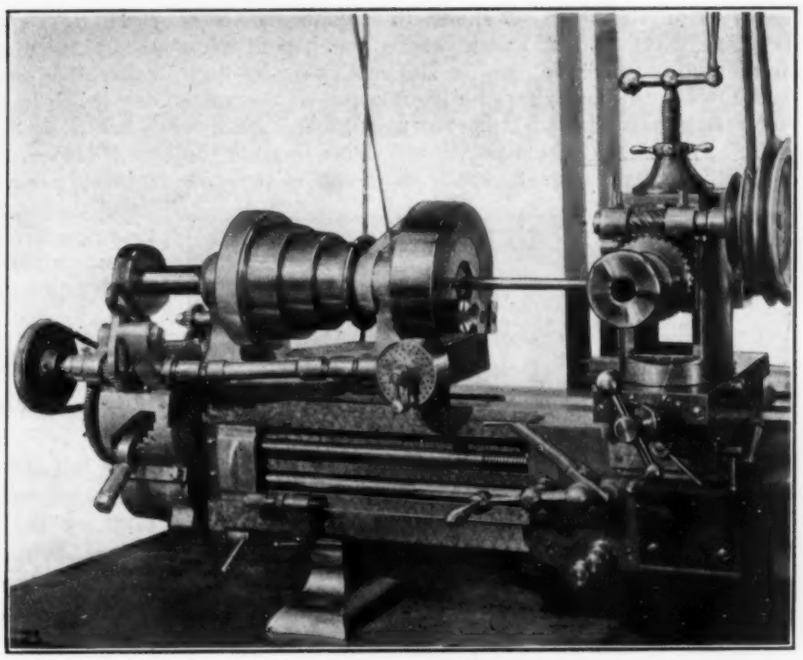


FIG. 23—THREAD MILLING ATTACHMENT ON LATHE

in Fig. 23 and in detail in Fig. 24. The experimental work on this attachment was done by the Waltham Machine Works. It is now produced by the Rivett Lathe & Grinder Corp. in connection with its traverse milling attachment, originally devised by Edward Rivett, and as improved by us by making it firm and substantial by the addition of the clamping levers shown at *A* and *B* in Fig. 24, and by putting a circular T-slot in the base of the column. In the spindle is

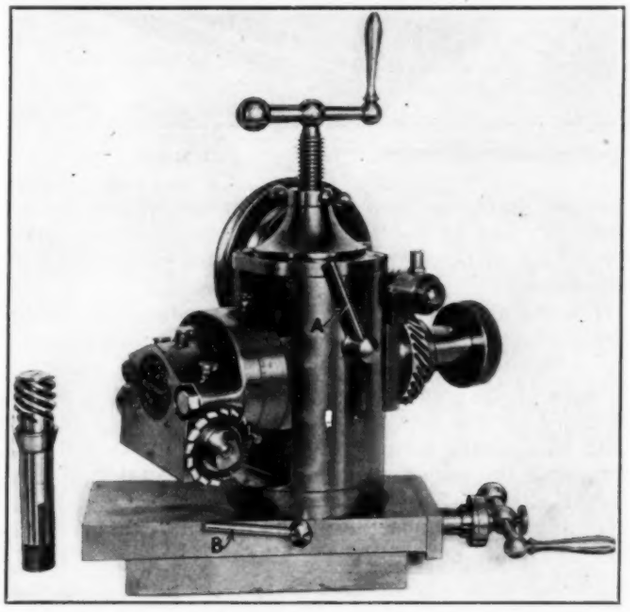


FIG. 24—THREAD MILLING ATTACHMENT SHOWING COLUMN AND CUTTER HEAD

mounted a collet with a 45-deg. worm, engaging in a right angle drive, and driving a spindle having the standard 3 and 45-deg. tapers, on which is mounted the thread-milling cutter. All standard threads can be milled readily with this attachment, and the only difficulty encountered was in securing the low speed necessary for driving the work. This speed was obtained, as

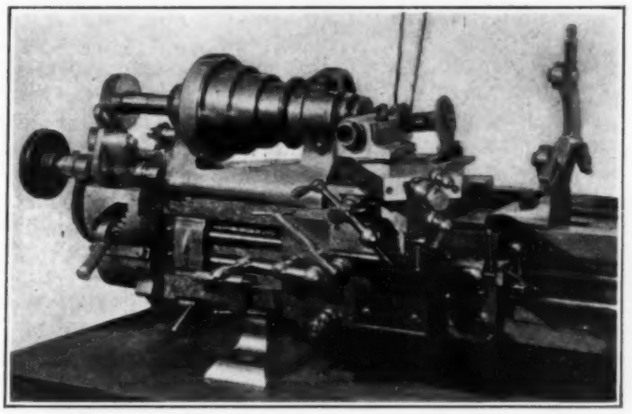


FIG. 25—LATHE SET UP FOR THREAD GRINDING

shown in Fig. 23, by means of an attachment originally devised by Edward Rivett for milling long lead spirals. It consists of a worm gear mounted on the spindle nose, and operated by a worm, the drive ratio being one to forty. It is a type of spiral head, and, in fact, a standard spiral head could be used advantageously for this purpose. In later designs we modified this arrangement and omitted altogether the use of the spiral head for thread-milling, by securing in another way the required reduction in work speed.

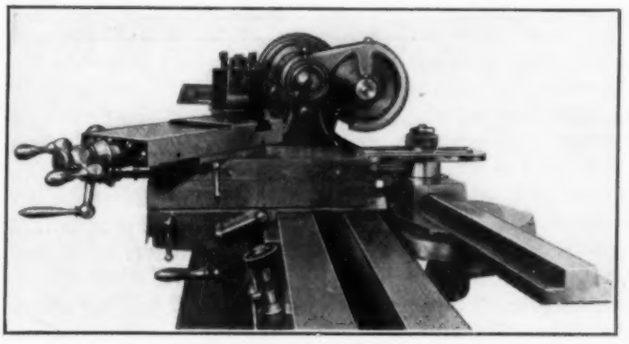


FIG. 26—TAPER ATTACHMENT, SLIDE REST AND THREADING DIAL

However, the arrangement shown in Fig. 23 has been very successful, and it has given us the benefit of a thread-milling machine, as we did not have enough work of this character for the installation of a special single purpose machine. It is evident from an examination of Fig. 23 that the order of the drive is from the worm to the worm-gear which is mounted on the

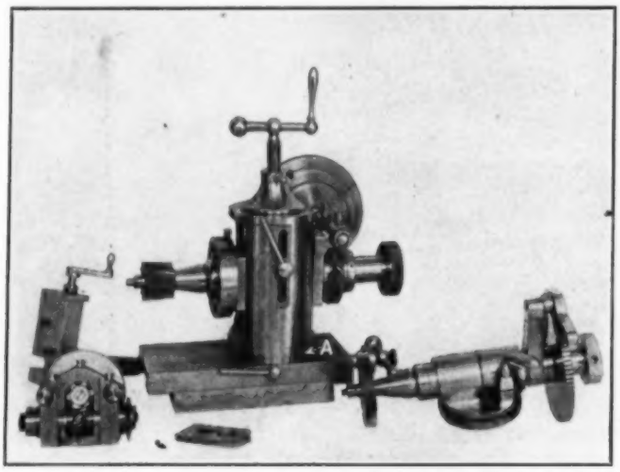


FIG. 27—MILLING ATTACHMENT, SHOWING INDEXING QUILL, THREAD MILLING DEVICE AND VISE

spindle nose, and thence through the spindle to the stud and through the gear box to the lead-screw.

There is shown in Fig. 25, a slide rest with a thread-grinding attachment, the illustration being plain enough to show the general arrangement. There is also shown in this picture a modified form of back rest.

In Fig. 26, is shown a modification of a taper attachment, which is easily understood without further explanation. It is always in position, and its neat and clean appearance represents a great improvement over the type ordinarily supplied.

For occasional milling operations we recommend a

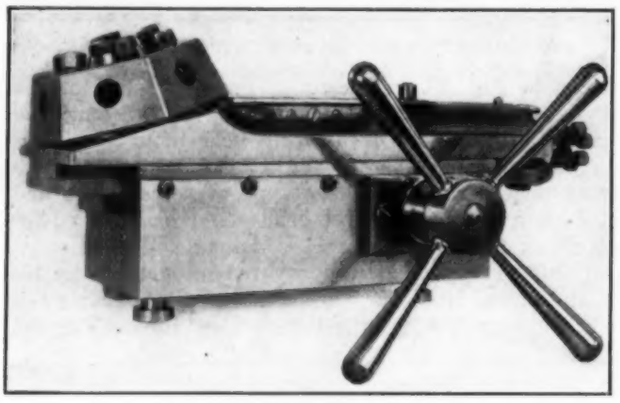


FIG. 28—TILTING TURRET

modification of the older form of commercial traverse miller, now supplied by the manufacturer, in the form indicated in Fig. 27. This figure shows the mounting of a block with a circular T-slot below the graduated ring *A*. It also shows a small vise, the thread-milling attachment, and a chuck and arbor holder, with quill and index plate. Occasionally, these milling attachments are very useful, but generally, all milling should be done on a separate bench milling machine, such as will be described in the concluding article.

There is shown in Fig. 28 a tilting turret, made for us by Hardinge Brothers, Inc., Chicago, which allows collapsible dies to swing. Turrets of this type will fit any bench lathe, and they are very useful in making the bench lathe into a screw machine. At the Emerson Co. in Medford there are two of these turrets in use in making parts for the Slocomb internal micrometers.

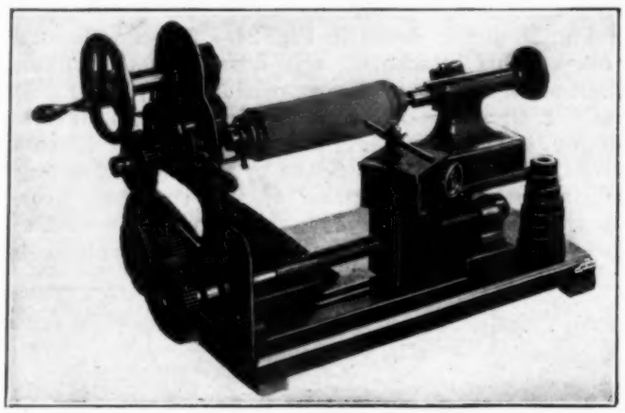
By the adoption of the devices described in this article, the Rivett Lathe & Grinder Corp. has inaugurated a great advance in its older type precision screw-cutting bench lathe.

Machine for Demonstrating Change Gears and Threads to Students

BY JAMES FORBES
Director, Southbridge Vocational School

The machine illustrated herewith was designed and built by the students of the Southbridge Vocational School, Southbridge, Mass., at the plant of the American Optical Co. It has been found very useful for teaching students simple and compound gearing, as well as the principles of thread cutting.

From the illustration, it will be seen that various



CHANGE GEAR AND THREAD DEMONSTRATOR

problems in change gears can be worked out very satisfactorily; and as the machine is supplied with a lead screw, the distance traveled by the nut can be readily determined.

The machine is provided with a split felt roll, which is constructed so as to enable a piece of drawing paper to be wound around its periphery, thereby enabling threads of different pitches to be traced by the pencil mounted on the nut. It is possible to trace a thread with this arrangement, and by opening up the roll and removing the paper, to study the helix angles of different pitches of threads.

Owing to its compactness and simplicity, the machine can be readily handled by the students.

Shop systems and methods which ignore the personality of the men and consider them as so many machines, are weak in that particular feature. No one or two men can do all the thinking necessary for a whole shop and unless the men not only are allowed, but are encouraged, to think about the work, the shop loses by it. This is one of the secrets of success of many a small shop that may apparently have no excuse for existence.

What About Automobile Shops?

BY A. L. DE LEEUW AND K. H. CONDIT
Consulting Editor, *American Machinist* Editor, *American Machinist*

Lack of uniformity in shop practice discussed in third article —Some tools not being driven to capacity—Screw machine departments good—Flood lubrication infrequently applied

LACK of uniformity in the machine shop practice on parts essentially similar in nature was an outstanding feature in the automobile shops we visited. It was not at all surprising to observe such a lack of uniformity in the railroad repair shops and a good deal of emphasis was laid upon it in the articles, "What's Wrong with the Railroad Shops," published almost a year ago. The railroad shop is primarily a repair shop and for that reason one expects to find variations in practice resulting from widely different equipment and from the effect of tradition. The automobile shops on the other hand are purely production shops. Most of the tools they use are essentially production tools and they do not differ widely in principle. The industry is so young when compared to the railroad industry that it has hardly had time to acquire very many hampering traditions. Even so there was the widest variation between speeds and feeds employed in exactly similar machines, on very much the same work in different shops. There must have been one best combination.

In this connection we have in mind particularly the milling operations which form so large a part of automobile shop practice. The milling machine is distinctly in its element in the automobile shop and should certainly reach its highest development there. Many of the models now in use, in fact, would hardly have been developed as soon as this had it not been for the needs of the automotive industry. Yet we found machines where the roughing and finishing cutters were so close together that both of them were in the work at the same time, as a result of which the finish was not all it might have been. Some instances of set-ups where the cutter spent considerable time cutting "wind" were noticeable but it is a pleasure to be able to say that they were exceptions to the general rule.

In one or two of the shops we noticed milling machines that were not being pushed to anywhere near their capacity by their operators. In some cases the machines themselves were too frail to stand the cuts that should have been applied. In other instances the operators evidently thought they were, which amounted to the same thing in the end. The men had been so used to the limited output of old style or worn out tools that they were afraid to use their new equipment for what it had been designed to do.

> WHY should the cutting speeds used in crankcase milling be four times as high in one shop as in another?
>
> Why should lard oil be used on one turret lathe and soda compound on its neighbor working on the same job?
>
> Why should milling jobs be set up so that the cutter is endeavoring to lift the fixture off the table?
>
> Flood lubrication of milling cutters is generally admitted to be essential to maximum output. Why is it not used more generally in the automobile shops?
>
> These are a few of the questions that come up when one has visited the big automobile production plants.

In some of the shops it was very noticeable that no attention had been given to the proper direction of rotation of the cutters. On machine after machine the cutter was doing its level best to lift the fixture off the table. In a few instances it was impossible to correct the error because of local conditions. In others the correct rotation could have been secured by running the piece through the other way. In still others the fixtures had been so designed that they had to be run through the way they were and nothing could be done about it.

The finest example of lack of uniformity in practice was one where three duplex milling machines, side by side, were all working on the same job, one that required two separate facing cutters. On one machine both cutters were going in the right direction, on the next machine both were going in the wrong direction, while on the third machine one was going in the right and the other in the wrong. And nobody seemed to know why.

JOB ON WRONG MACHINE

In another department we saw a first-class operator working an end mill gingerly out of the side of a tough steel casting. The machine was a new one, the cutter was in good shape and the fixture was above criticism, yet by the very nature of things extreme care was required on the part of the operator to prevent digging in and a smash up with the type of cutter he had to use on that particular material. There was no reason at all why the job should not have been done in considerably less time with a pair of interlocking side mills.

When it came to coolants the lack of a definite policy was much more evident in some shops than in others. In one place we saw two turret lathes of the same make

working on the same job, one using a soda solution the other lard oil.

The theory of flood lubrication and its importance in securing maximum production is evidently not universally understood. We saw a great many machines whose output could have been materially increased had flood lubrication of the cutter been applied. On some of these machines the supply of coolant was entirely adequate for flood lubrication but the discharge nozzles were not properly arranged and no guards had been provided. It might almost be said that where flood lubrication was in evidence production in general was at the highest point reached in any of the shops indicating that the men who knew most about high production methods were fully aware of the importance of flood lubrication.

The lack of uniformity in shop practice which we have endeavored to bring out through quoting particular cases indicates that all is not as it should be in shop management. There was a day when the man who knew most about shop practice was the man in charge of the shop but that is not always the case today. The shop is a bigger shop, the methods employed are much more highly developed and complications innumerable have added to the problem. As a result the man in charge must be primarily an executive. If he has a thorough knowledge of shop practice so much the better. If he has not, the assistant in charge of mechanical details will have to work pretty much on his own responsibility. In very few shops is there any means of checking up on what he does. Even if the manager should be an experienced shop man it is questionable whether he would find time to do very much in the way of checking up on his mechanical supervisor.

Problem of the Mechanical Supervisor

We believe that this situation has much to do with the lack of uniformity displayed. No matter how good the mechanical supervisor may be when he comes on a new job he has certain good ideas and inevitably a few bad ones. Within a reasonably short time he has put his good ideas into effect and improved the practice in the shop to that extent but after that he has only the bad ideas left and he will stock up for them as tenaciously as for the good ones because they seem entirely sound to him. If he had someone to walk around the shop with him periodically and offer suggestions that occur to a man who is not too close to the job he could easily profit by the ideas thus received. As it is he is doing the very best that can be expected under the circumstances.

No corporation would think of letting the work of its accounting department go unaudited even if the law would permit it to do so. Why should it not take a similar attitude toward its machine shop methods? If the works manager has not the knowledge or the time necessary to conduct such an audit it would be necessary for him to rely upon someone else. In the case of the big corporations such assistance should be readily obtainable from members of the advisory staff employed by them. We are convinced that even the few suggestions we are able to make in these articles are sufficient proof that such an auditing of shop practice is an entirely feasible thing and would work greatly to the benefit of the industry.

Before we leave the subject of milling a word ought to be said about the rather wide use of square cornered teeth on large size cutters. Apparently the weakness of such a cutter tooth as compared to a tooth with a 45-deg. bevel at the corner is not widely understood. The beveled tooth probably has 100 per cent longer life than the one with the square corner. There are pieces, of course, where the beveled tooth cannot be used on account of the engineering design but there are surely a great many more where the piece can be changed by the designing engineer to permit the use of the beveled-tooth cutter without sacrificing anything in the way of utility or appearance. As a matter of fact many weak sections would probably be strengthened by the substitution of a 45-deg. fillet for a sharp corner.

The screw machine departments of the automobile plants we visited are highly important parts of the industry and are generally excellent. We did see a few things, however, to which exception might be taken and which we are recording in the hope that they may serve as suggestions to the heads of screw machine departments everywhere.

It was noticeable for instance that one shop was employing a multiple spindle machine for making a small stud where the total output necessary for three months' factory production was produced in one week. There is no objection to getting production through rapidly but the use of a machine of this type for such a piece means that a large stock of product must be carried or else the tooling must be changed frequently.

Side by side with this job were several single spindle machines working constantly on another job. It happened to be a job that could have been done perfectly well on the multiple spindle machine and to better advantage. It would seem here that better efficiency could have been secured by the shifting around of the jobs.

In another place we saw a battery of special machines which were used for final reaming of pieces made on automatics. Evidently somebody did not trust the screw machines to turn out a finished job. Whether the lack of confidence was in the machine themselves or in the way they were operated did not appear.

As for the special machines, they were not particularly efficient. The same work could have been done on multiple spindle equipment available in the current market with a reduction in the number of operators by five sixths. In other words, one man with the better machine could do the work of six with the old type.

Among other criticisms of screw machine work we might include the employment of turning operations where forming would have been better. Also the too wide setting of dogs so that an unnecessary amount of "wind" cutting took place. It might also be mentioned that quite a few jobs were on machines that were really too big for them. In most cases this was not the fault of the engineers or the head of the screw machine department. It was simply a case of not having a machine of the right size available. At the same time the production costs could have been lowered if a proper balance of machine equipment had been provided, for the machine overhead on the small part produced on the large machine was disproportionately high.

As to turning operations there is not a great deal to be said, for in the larger shops most of the turning is done on specialized machines that are highly efficient. Particular attention has been paid in them to rigidity of construction and proper supporting of the tool to allow for its being pushed to the limit. We did see a few cases where tool overhang was excessive but they were the exception to the rule. The same may be said of grinding of tools by the machine operators.

The Lathe Department

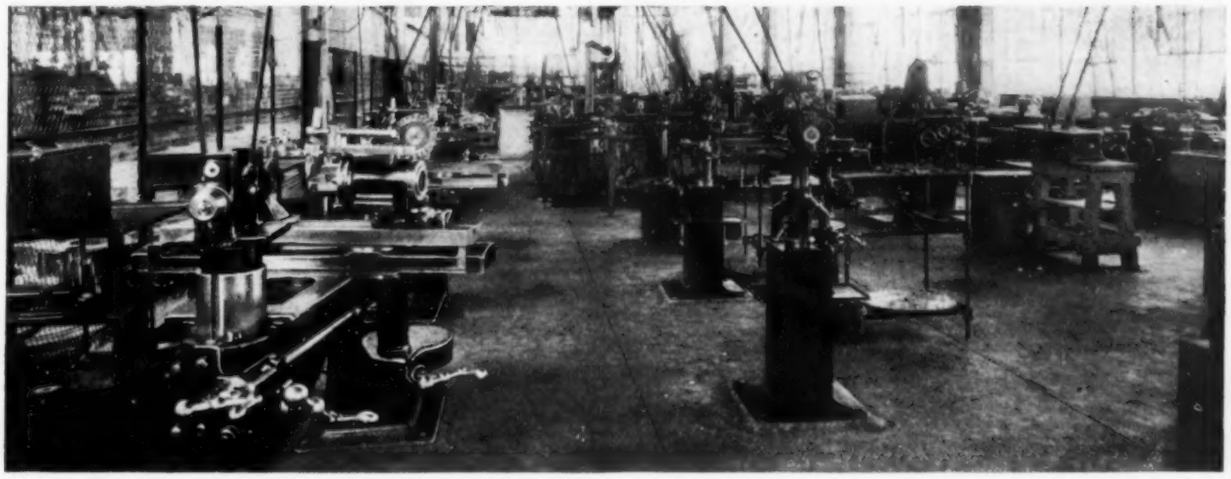
Where Machine Tools Are Made

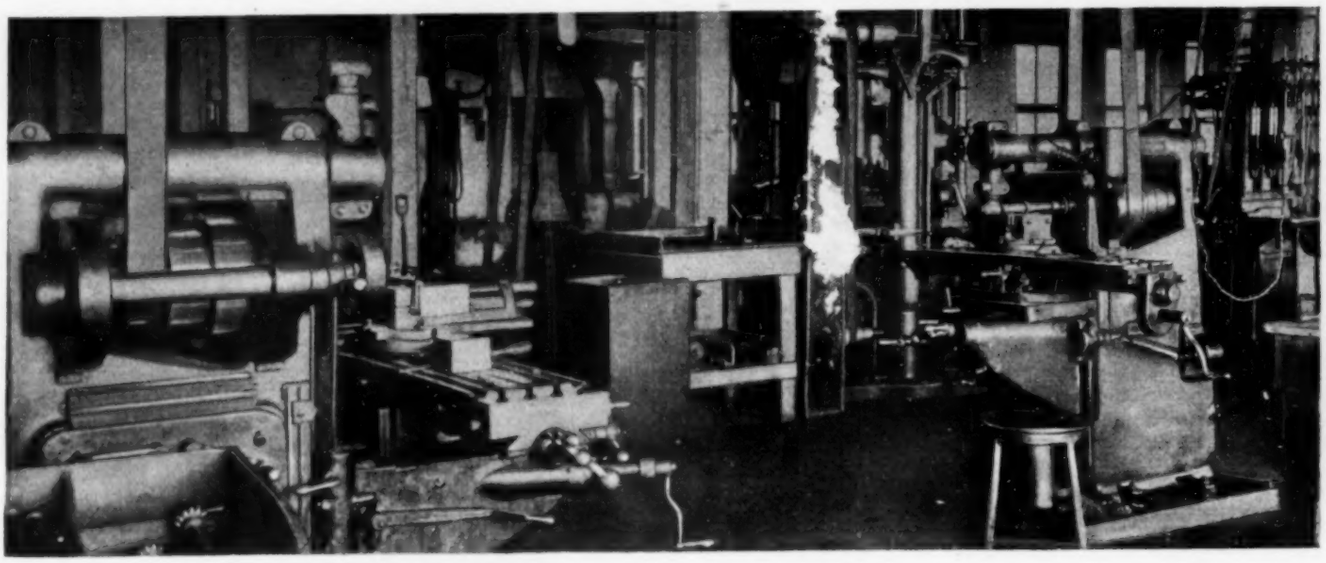
Landis Machine Company

Incorporated 1903

Milling and Grinding Department

The Tool Room



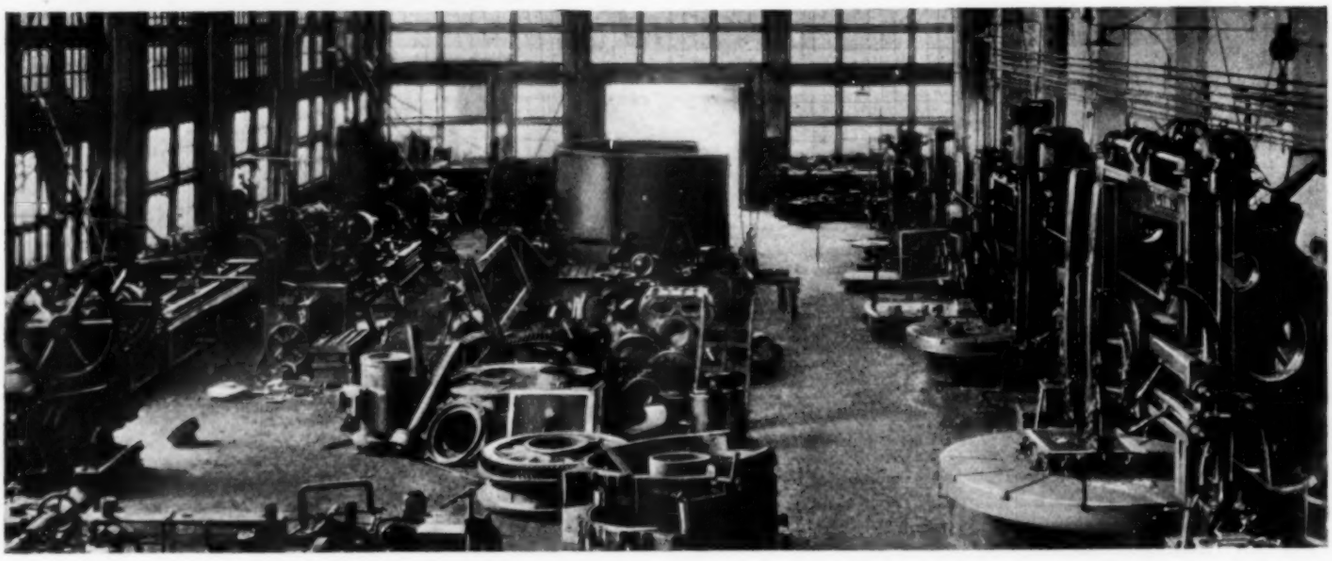


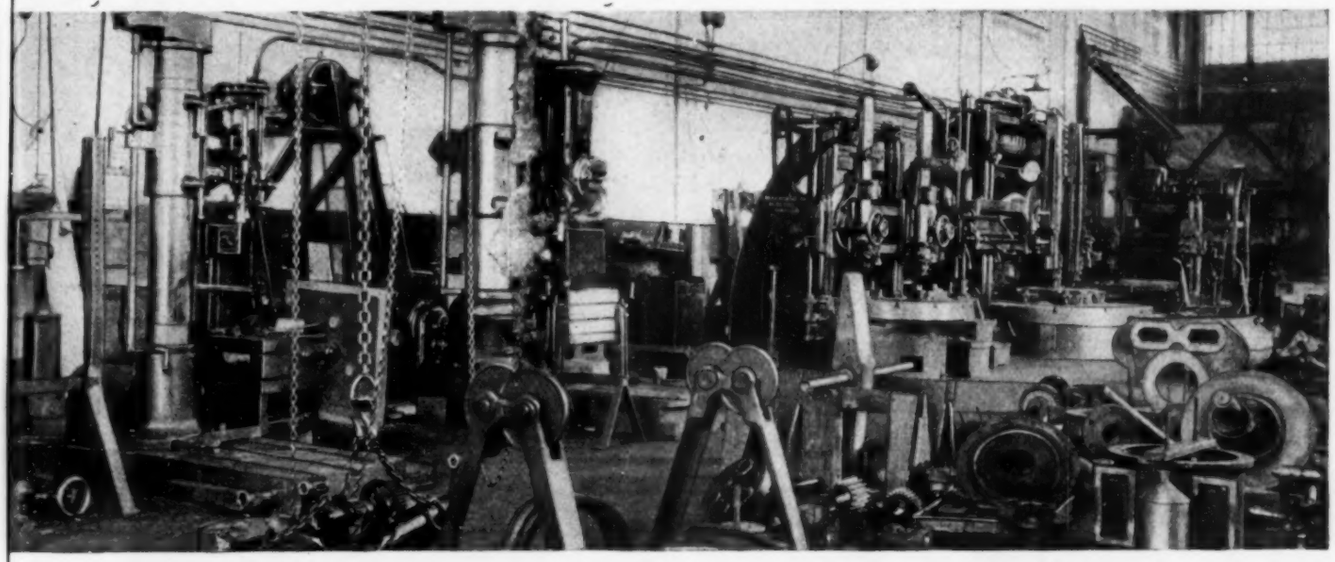
Many Machine Tools Are

WHEN the flapper clerk in your office is chewing gum does she think about how it is made and the machinery used in its production? Not on your life she doesn't. All she cares about is the gum itself and whether she has the price to get it.

Much machinery is necessary for the production of chewing gum. Then it must be wrapped and made into packages—all by machinery. To build and keep in repair the many machines, machine tools are required. The picture at the top of this page and the one on the left are from the machine shop of The William Wrigley, Jr. Co., Chicago, Ill., maker of chewing gum. Here the production machines are repaired and new ones built.

The time is here when the delectable waffle appeals to your palate. You cover your waffles with syrup and taste the delicious combination. You know how the

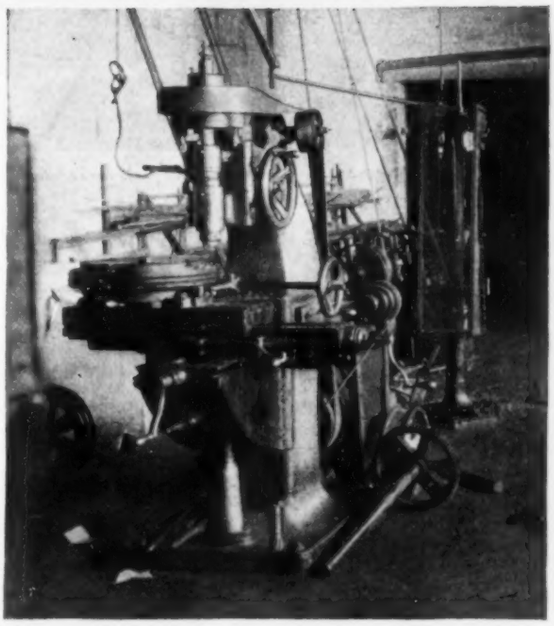


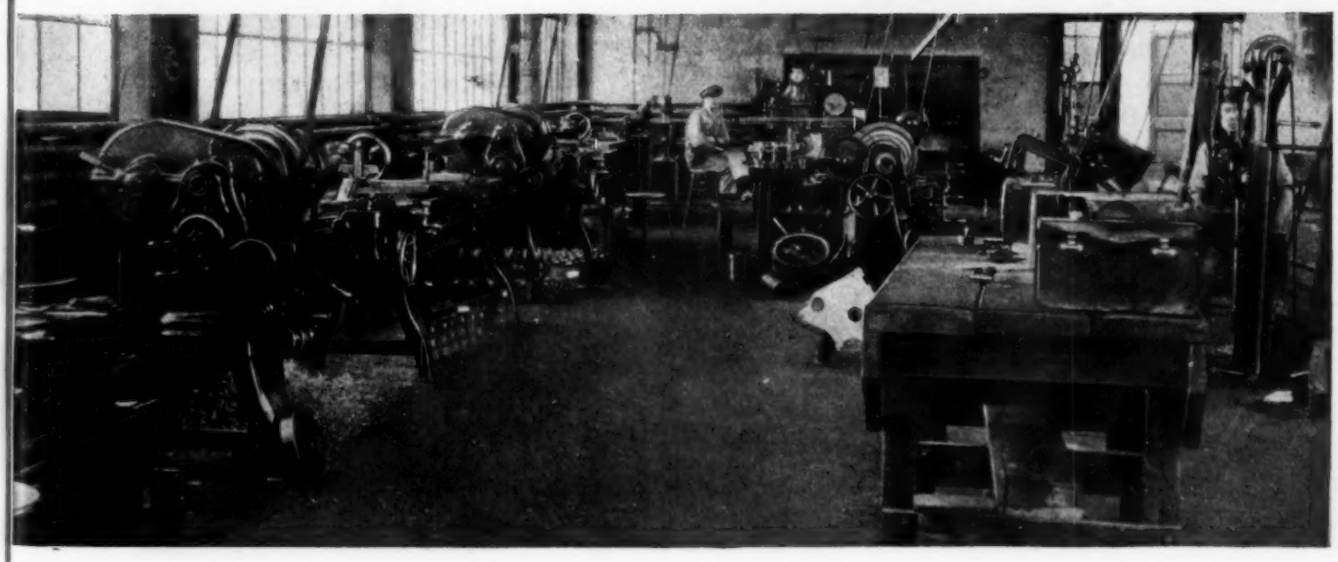


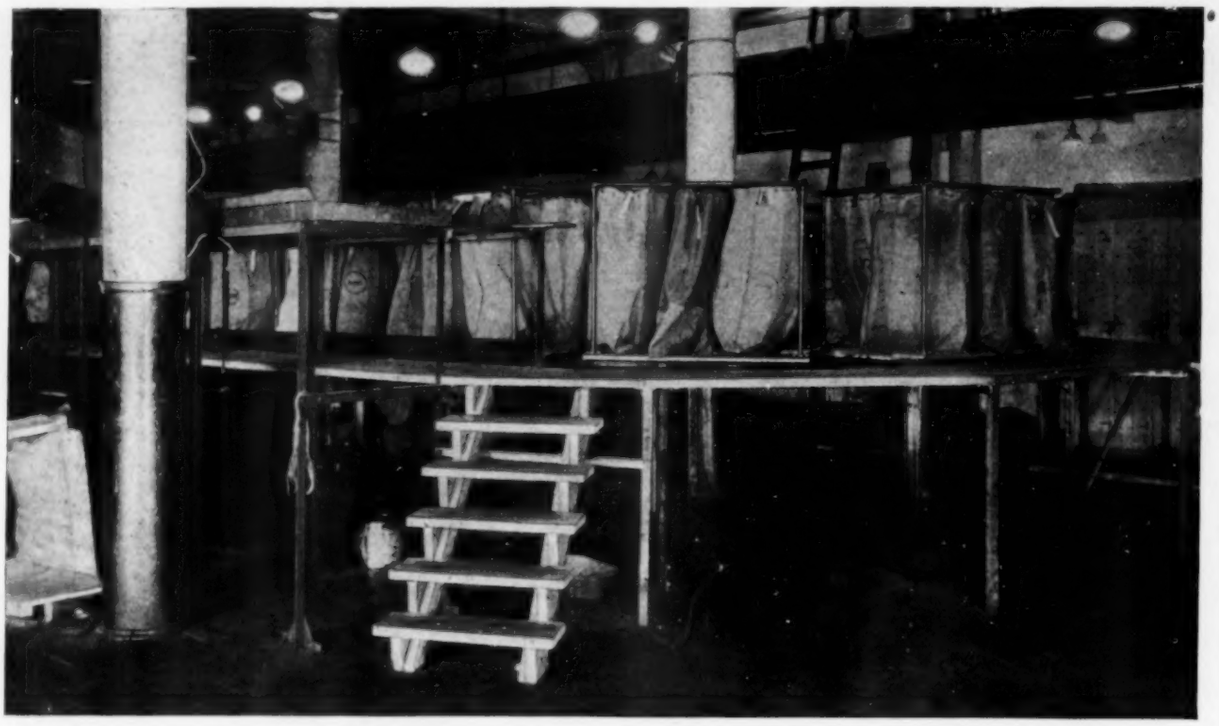
Used in Unexpected Places

waffles are made—friend wife is an expert—but how about the syrup? The raw material must go through many processes before it becomes syrup, requiring much heavy machinery. Then cans, labels and boxes must be made for shipment. All the necessary machines have to be repaired and new ones built from time to time and that's where machine tools come in.

The last picture on the opposite page and the ones on this page are from the machine shops at the plant of the Corn Products Refining Co., Argo, Ill., where Karo Corn Syrup and other products are made. The first two pictures are from the shop where heavy machines are built and repaired. The one at the right shows one of the machines used in making and repairing dies and tools for the can-making department. The picture at the bottom is of the shop where light repairs are made and experimental work is done.







Machinery Helps Sort Parcel Post

Parcels are delivered by chutes to the tables as may be seen in the foreground of the picture above. The bags have colored tags attached, each color representing a geographical destination, and are kept in continual motion so that each bag comes before the sorter at stated intervals. This device occupies much less room than stationary racks of bags having equal capacity and saves the time formerly lost by the sorter in walking to and fro from bag to bag.

Below is a close-up view showing the sorter's platform and tables together with the merry-go-round of bags.

Casting Crown Brasses and Hub Plates in Place—Discussion

A group of letters from railroad master mechanics telling how locomotive crown brass and hub plate repairs are handled on their respective railroads

THE METHOD of casting locomotive crown brasses and hub plates in place which is in use at the Lackawanna Railroad shops and which was described by Fred H. Colvin on page 479, Vol. 59, of the *American Machinist*, struck us as so good an example of advanced practice that we asked a number of railroad shop officials to comment on it and compare it with their own practice. To conform with the policies of several of the railroad managements it has been found necessary to omit the names and connections of the authors of the various letters abstracted below. The eleven points of view expressed give an excellent cross-section of present-day railroad shop practice on crown brasses and hub plates.

First Shop

We cast the crown brass and liner in our foundry in nearly every case. This method gives very good results and saves a lot of machine work. From our engines of the 4-6-0 class we have obtained as high as 115,000 miles and in nearly all instances the engine runs from the time it leaves the shop until it has to be brought in for general repairs. The shop here is small and we get out only four or five engines a month. As a rule the engine is in the shop about four weeks.

We also cast crown brasses in all locomotives except the Mikado. Before casting the brass we cut dovetailed grooves into the boxes, both for the crown brass and hub wear liner. Arbors of the proper size are set in the box and the brass is poured around it. We have very little trouble with them at any time.

Second Shop

Our driving box is machined to receive the crown brass, this work being done on a slotter. A dovetailed groove is turned in the face of the box that goes next to the wheel. The crown brass is turned to fit the driving box, a shoulder being left to stop the brass when pressed into the box. This leaves the brass projecting about an inch beyond the box on the end where the wear plate is to go.

After these brasses are fitted and pressed (hydraulically) into place, the boxes are then sent to the brass foundry and a brass liner is cast onto the face of the box. The boxes are then sent to boring mills where they are bored to fit the axle and the hub liners faced off until each box face is the proper distance from the engine frame.

The inside of the wheel hub is faced off on a lathe and to this face is bolted the hub liners. These hub liners are cast of common gray iron and are turned and faced to fill the space between the hub and driving box, allowance being made for the proper amount of lateral motion, about $\frac{1}{8}$ in.

After the engine has made a certain number of miles in service these boxes are taken down and the lateral motion is taken up by casting on new brass liners as outlined above. Our locomotives are supposed to make 100,000 miles from one general overhauling to another. In a general overhauling every part, of course, is thoroughly inspected and overhauled but it is not always found necessary to remove the cast-iron hub liners.

Here is a point that I think is against casting the crown brass and wear plate together. When we first began the use of the Mikado type of locomotive, the piston heads were of cast steel. Around the outside rim of these heads a ring was cast into which the grooves for the packing rings were turned. These false rings that were cast onto the steel heads were continually coming loose and turning around on the steel heads. It was finally suggested to put screw bolts into these steel heads and let the heads of the bolts project above the outside rim of the steel head. This worked all right so far as the prevention of the turning went but the rings were still loose after a short time. The plan of preheating the steel head before pouring the metal on was tried and the fault was corrected.

I fear from the above experience that the crown brasses might become loose. This is caused by the unequal expansion of the two metals, or rather the contraction of the brass while the steel is really expanding.

Third Shop

I read the article regarding pouring driving box brasses and from my experience I am sure it will not give very good results. The pouring of crown brasses is not a new idea, but in order to have any success at all the boxes must be heated to about 900 deg. before pouring. If this is not done the brass will be loose. Even when the box is heated the brasses are not perfectly tight.

We do not pour our crown brasses for the reason that it is almost impossible to get them perfectly tight and the quality of brass is not so good. We believe by purchasing our crown brasses from a reputable manufacturer of brass we get a better and more uniform grade of material.

Our practice is to machine the rough crown brass and press it in leaving a projection about one inch above the box and then pour the hub face around it.

If the work is properly done in the shop and the engine is properly maintained and lubricated, crown brasses should run two shoppings or from 150,000 to 200,000 miles. Hub faces should run from shopping to shopping under the same conditions.

Abnormal hub face wear is brought about by the same cause as flange wear. This can be prevented if work is properly done in the shop. If it is, when the engine has made her mileage and receives class 4 repairs about ten days in the shop is required. If, however, the engine is shopped on account of sharp flanges and hub wear, it will be in the shop from two to three days.

Fourth Shop

In considering the method of adjusting lateral motion on driving wheels by application of liners, the type of locomotives and the conditions under which they are used (such as passenger or freight), are factors to be considered in comparing mileage derived from their use. On narrow firebox locomotives the clearance at rear driving wheels is limited, the same amount of wear cannot be allowed and in consequence the amount of mileage is reduced.

We have used steel or brass liners on driving-wheel hubs for years with fair results, the main objection being on account of their getting loose or broken. These liners were used in conjunction with babbitt-lined boxes. This method was replaced about three years ago and the liners are now cast on the face of driving boxes.

The driving boxes are prepared by having dovetailed recesses cut on the face and the metal poured into a mold of the desired thickness. To procure further adhesion, the face of the driving box has several holes drilled at an angle and about ⅜ in. deep. The driving wheels are maintained at original thickness by the application of steel plates welded to the face of hubs.

Boxes treated in this way will generally run from one shopping to the next or from 25,000 to 30,000 miles for heavy freight locomotives and on lighter locomotives from 40,000 to 50,000 miles. Some of the lighter passenger engines give as many as 90,000 miles between shoppings.

Some of the heavier locomotives have wearing blocks clamped to axles between the driving boxes which assume considerable of the lateral wear. The crown brasses are generally worn enough to warrant replacement at the same time that lateral wear is adjusted.

The lateral wear between driving wheels is taken up at the same time that other parts are being readjusted or replaced and does not cause any additional delay of engine in the shop.

Fifth Shop

Our practice of applying lateral plates on boxes is to dovetail the box and preheat it before the molten brass is poured. Crown brasses are separate and are first pressed into the box and lateral brass poured around them. Lateral brass is mostly composed of scrap crown brass. Its life varies and is determined by the service but will average around 80,000 miles.

We do not renew the crown brass at the same time, unless it is too thin to apply a shim, providing it is loose in the box. If it is not loose and it has the required standard allowance for thickness, it is re-crowned and placed back on the journal. Our practice is to shim all but the main boxes on a classified repair unless the crown brass is thin and then a new brass is applied. It is then possible to double and sometimes more than double the mileage of crown brass.

Locomotives in for the taking up of lateral motion are in the shop on an average of six days. This takes care of our different types of power. Our facilities are far from modern and if they were modern no doubt faster time would be possible. Rod work is taken care of when recrowning boxes, and rods should also be lined up where needed so that when the locomotive goes back into service the rods and boxes are in good shape.

Sixth Shop

We have poured some brass hub liners onto driving boxes but have never poured the crown brass in connection with the hub liner, the crown brass always being separate and pressed in first.

With separate brass hub liners we secure about 75,000 to 80,000 miles before they require renewing and the crown brass is usually worn sufficiently to require renewal at that time. We generally do this when giving the engine heavy or general repairs.

Brass hub liners are not general practice, however, and have only been applied on a half-dozen or more engines that I know of. The standard practice on this road is to apply the crown brass and fill up the hub plate space with babbitt.

Seventh Shop

The method of the Lackawanna railroad is practically identical with the method which has been in use on our road for several years. The only difference is that instead of using cast-iron cores we use dry sand cores. The process has been very successful on our road and has eliminated entirely the loss of hub liners which frequently happened when the hub wear plate was put on the box separately.

These hub plates will wear to the point where lateral motion is excessive before the crown brass requires renewing and our practice is to apply a loose hub liner made of sheet steel of thickness necessary to take up the lateral. These liners are made in two pieces and after being placed in position the edges are welded.

We formerly poured the hub wear plate on the box after the crown brass. On account of the trouble caused by these hub plates being lost on the road we began, about four years ago, to pour the hub plate integral with the crown brass itself.

Eighth Shop

Our driving box crown brass is a separate casting and is machined to fit the box on a Morton drawcut shaper with special attachment. It is then pressed in the box using from thirty to eighty tons pressure, according to the size of box.

If the brass liners on the shoe and wedge faces of box are ¼ in. or more thick, they are planed central to crown brass. If less than ¼ in. the old liners are planed off and new ones cast on. The liners are anchored by two diagonal dovetail grooves, ⅜ in. wide, ¼ in. deep, planed full length of box, making it impossible for the liners to fall off.

If the hub face of the driving box is worn ⅛ in. deep, it is grooved out on a boring mill ¼ in. deep and the same diameter as the hub on the driving wheel. A piece of ⅜-in. boiler plate is electrically welded on the box which brings it back to standard. The crown

brasses are then bored out central with the shoe and wedge face on a horizontal boring mill, two at a time.

Driving wheels are counterbored out ½ in. deep and a two-part brass liner is applied. It is fastened with 8 copper rivets ⅝ in. diameter. The thickness of liner is determined by the thickness of flange on driving box. Any variation in width of engine frames and on the face of the box is made up with the thickness of this liner.

Ninth Shop

Most of the larger shops at the present time are casting hub wear plates right into the driving boxes. We, however, have no facilities for doing this work and still use the babbitt liners which last from shopping to shopping. I do not know but they give us as good service as the brasses and are more cheaply applied.

Our method is to take some strips of front end or smoke box netting and spot weld them onto the boxes before pouring on the babbitt. We use probably about 10 of these on a box and I do not know a single case of these liners losing off.

On our heavy power it is not often the wear of the crown brasses that is the cause of renewal but generally owing to the brass getting loose in the box. This is because the end sometimes gets warm due to the grease sticking and not getting up to the journal or from lack of care in refilling in our roundhouses. We do not shim any crown brasses on modern power.

On the modern power in this district we usually renew the main driving box brass about every eight months. At the same time we have to give the engine a partial change of flues owing to our extremely bad water condition as we have one section where flues have to be renewed about every four months.

The mileage we get from hub plates varies but as a rule we get 60,000 or 70,000 or even 100,000 miles from our front and back boxes. This is a matter that is largely controlled by soil conditions of the right of way. Where you have sand with considerable wind, both your bearings and hub plates will wear much more rapidly than where a heavy soil prevails. With heavy soil we have very little trouble from hot bearings.

Tenth Shop

In checking up the mileage on the various classes of locomotives on our line I find that we are making in the neighborhood of 180,000 miles with driving brasses, and are getting about 60,000 miles on engines before lateral motion has to be taken up. I also find that we take up the lateral motion three and four times before the crown brasses are worn sufficiently to remove them.

We do not practice pouring the driving brasses on this division. We do, however, pour the hub plates and also the shoes and wedge wearing surfaces on driving boxes with brass only, no white metal being used.

One of our divisions does pour the driving boxes in connection with hub plates but after doing it for some years they are now giving it up. The reason is that it seems practically impossible to hold driving brasses perfectly tight under this method and they are going back to the old method of pressing brasses in by means of the hydraulic press.

It is quite possible that the care taken at the Lackawanna shop to swab the metal core with oil before pouring such brass, may result in securing a crown brass casting which will stay tight longer than ours.

The pour method for the hub plates and shoes and wedge surfaces is very satisfactory and superior to anything else we have ever tried. We have been using it for the past twelve or fifteen years.

Eleventh Shop

The present practice followed by us calls for crown brasses to be machined all over. The driving boxes are slotted inside and the crown brasses are pressed into position. Hub face liners and shoe and wedge face liners are applied by pouring melted brass on the face of the box, the method of preparing the box for the application of these hub face liners being substantially the same as that followed by the Lackawanna.

Some time ago we made a trial of driving boxes having crown brasses and hub face liners cast in them, in accordance with the practice described as being standard on the Lackawanna. These driving boxes and brasses gave satisfactory service, but the arrangement was found to be undesirable for the reason that outlying roundhouse points were not equipped to apply new brasses by this method.

We find that as a rule the hub face liners wear out much faster than the crown brasses. It is, therefore, desirable to make the hub face liners entirely independent of the crown brass in order that the hub face liner may be renewed without removing or disturbing the crown brass. We are able to handle driving box brass work in this manner under our present practice, but it seems to me that it would be difficult to renew the hub face liner without disturbing the crown brass in a box having brasses applied in accordance with the Lackawanna practice.

We require the material in crown brasses to meet certain specifications which are quite exacting as to chemical and physical requirements. It seems to me that the practice of casting crown brasses in place in driving boxes at a number of different shops would make it difficult if not impossible to control the quality of material entering into these brasses. Our present practice as regards hub face liners is to provide material for these liners by melting up scrap brass which accumulates at the various shops. This material has proven satisfactory for lateral and shoes and wedge face liners.

We have experienced some trouble in the application of hub face and shoe and wedge face liners by the provisions above described. The heat from the melted brass in some cases causes the boxes to become badly warped and has no doubt been responsible for failure of a number of boxes, due to cracks developing in them. The tendency would, no doubt, be increased if the present practice of casting brass liners in position in the boxes were to be extended by including the crown brass.

I feel that the practice of applying driving box brasses and brass liners to shoe and wedge and hub face meets the requirements of the service in a satisfactory and economical manner.

There's a difference between abusing a lathe by overworking it and abusing it through carelessness or cussedness. Mighty few lathes are overworked either by depth of cut or too much speed or feed but many show scars and dents from wrenches and work falling on them which could have been prevented by a little care. It's running near to the overworking line that gets out the work.

Swaging Automobile Axles

By John Williams

AN INTERESTING application of the process of swaging to the making of axles for automobiles is shown in the accompanying illustrations whereby several turning operations are eliminated and a saving of stock affected that amounts to many tons in the course of a year's production. The drawing Fig. 1 shows the axle as it comes from the swaging operating.

The bar of stock from which the axle is made is 28 in. long, 3 in. shorter than the finished piece. Not only is the bar extended to gain the extra length, but the metal is made denser by the hammering of the swaging dies so that the structure is improved. The swaged

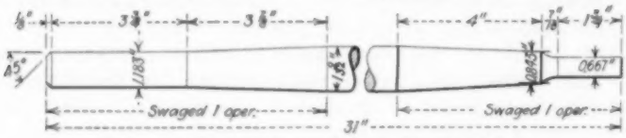


FIG. 1—DRAWING OF COMPLETED AXLE

ends are finished directly by a grinding wheel without intermediate lathe work.

The reducing member of the outfit, shown in Fig. 2 is a No. 6 H. S. Type Langelier swaging machine, water jacketed to conduct away the excess heat and preserve the temper of the dies. It is fitted with an automatic acting, air operated chuck to hold the work so that the workman has but to take a heated piece from the furnace, place the cold end in the chuck and move it forward by means of the capstan-wheel. The piece is gripped and released without conscious effort on the part of the operator.

A Langelier continuous rotary furnace, Fig. 3, heats the axles for the swaging operation. They are held

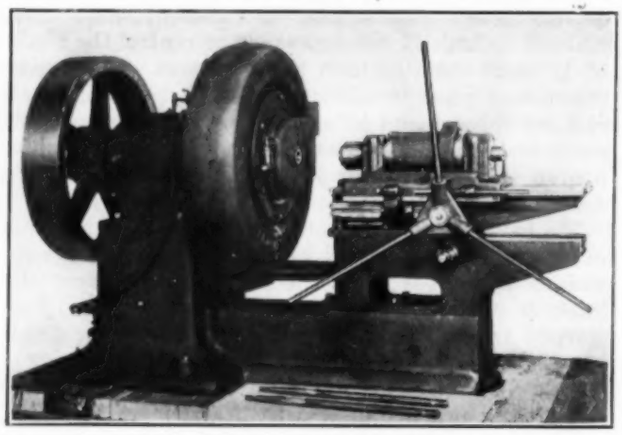


FIG. 2—THE SWAGING MACHINE

in an upright position by means of two circular tables keyed to the continuously rotating central shaft. Cup-shaped supports are bolted to the outer edge of the lower table to receive the lower ends of the pieces, while spring clamps around the periphery of the upper table pinch them at a point sufficiently removed from the upper end to allow a proper length to be heated. The vertical position of either or both tables can be altered by means of a rack and pinion movement to suit various lengths of work.

The furnace proper consists of an annular chamber enclosed at the top and sides by specially molded U-section fire bricks. The chamber does not form a complete ring; a section of the circle sufficient to provide loading space being cut away. The chamber is open at the bottom all the way around and the entering end is also open.

The central shaft is driven through the medium of worm-wheel and worn by a round belt from the countershaft of the swaging machine. A pair of 3-step cone pulleys provide for changes in speed according to the nature of the work. The rate of speed may be varied

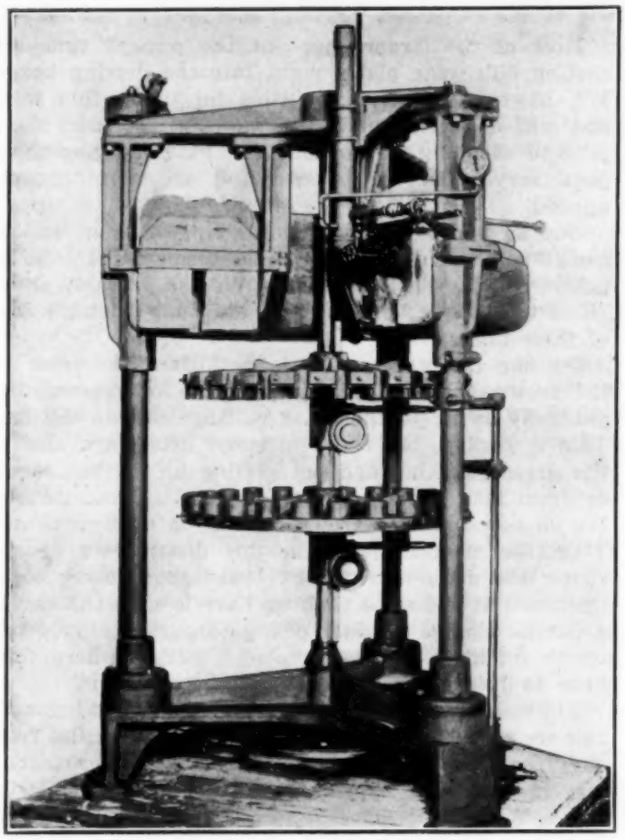


FIG. 3—THE ROTARY FURNACE

from 1 rev. in 3 min. to one rev. in 6 minutes. There are 24 positions to the table. As the operator sets each piece in succession into the holding device, it is carried slowly around the circle with its upper end projecting into the fire chamber. The length to which it is heated is determined by the vertical position of the carrying tables, and is sharply defined; a distinct advantage in hot swaging operations.

If the carrying tables are revolving at their slowest rate, 1 rev. in 6 min., it requires something over 5 min. to raise the heat of the first piece to the desired temperature, but as in the meantime the remaining positions have been loaded, the machine delivers a heated piece every 15 seconds after the first revolution. When a piece has passed through the cycle and is approaching the closed end of the annular fire-chamber, the operator grasps it by the cold lower end, lifts it slightly to disengage it from the cup of the lower table, and allows it to drop endwise out of the clamp of the upper table. Should he be delayed, or the furnace be moving too fast for him to keep up, the piece contacts with a tripping lever and automatically stops the rotative movement. A treadle re-engages the clutch when the operator is ready.

German Standards for Tolerances and Allowances in Machine Fits

By OSCAR R. WIKANDER

THE FIRST question for the individual manufacturer to decide is whether he shall adopt the unit bore, DINORM 777, or the unit shaft system, DINORM 778.

In order to keep the tool expense as low as possible it is, of course, advisable to confine oneself to the practically exclusive use of *one* of the above systems and this is, as a rule, possible.

The characteristic feature of the unit bore system is that for each basic size, all the bores have the same diameter and, within the same grade of fits, the same tolerance, while the different classes of fits are obtained by changing the size of the shaft. For each bore only one reamer (as long as the material remains the same), one plug gage (within the same grade of fits) and one arbor are necessary. Gears and other machine elements with internal bores can be manufactured in quantities and kept in stock, each part being suitable for any class of fits and interchangeable with any other part of the same bore.

For this and other reasons, which are explained at length in the DIN-BUCH, the unit bore system is, as a rule, the preferable one. It has been adopted by the locomotive and car builders, the machine tool, the automotive and the pneumatic tool industries.

In the unit shaft system, the shaft diameter and, within the same grade of fits, the shaft tolerances, are the same for each basic size and the different classes of fits are obtained by changing the size of the bore. For each bore as many reamers, plug gages and arbors are necessary as are classes of fits being used.

For each basic size there is, however, only *one* size of shaft, and cold-rolled or drawn material can in many cases be used without requiring any machining whatsoever. But even when machining is necessary, the economical advantages of using a uniform size of shaft or pin are often considerable.

For transmissions, for example, it is necessary to use the unit shaft system, because it must be possible to place standard pulleys, couplings, etc., anywhere on the shaft and because it is customary to use cold-rolled shafts without machine work. Similar considerations will lead to the adoption of this.

BIG CLEARANCES — DIN 170

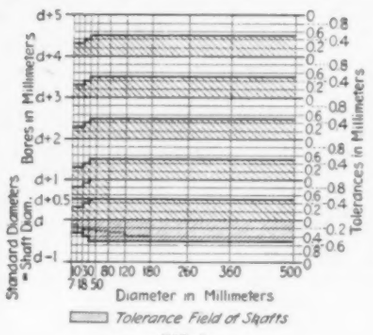


FIG. 1

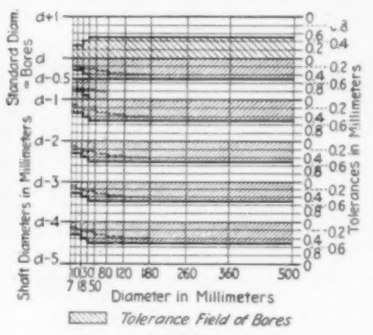


FIG. 2

1—For "Big Clearances" which correspond to a coarser Grade of Fits than "Coarse Grade of Fits," the following minimum clearances are used: 0.5, 1, 2, 3 and 4 millimeters.

2—These clearances are indicated by the difference of the dimensions given on the drawings; for example, in case of 1 mm. clearance: shaft 35 ϕ, bore 36 ϕ. *One* basic size for shaft and bore is not used and the "big clearances" are therefore not "machine fits" in the more restricted sense of the words.

3—The shaft dimensions indicate always the maximum size, the upper variation being *O*, the lower negative. The bore dimensions indicate always the minimum sizes, the lower variation being *o*, the upper positive. The variations must be given in figures according to Din 406, Sheet 3; for example: shaft 35 ϕ — 0.5, bore 36 ϕ + 0.5.

4—If two parts do not move in relation to each other, and it is only required that the one shall enter the other, shaft and bore may be made to the same nominal size, the minimum clearance thus being zero.

5—As a guidance for the upper variations of the bores, 30 *PE* may be used up to 50 mm. ϕ, and 0.5 mm. for all sizes above 50 mm., as shown in the following table:

Base	7 to 10	above 10 up to 18	above 18 up to 30	above 30
Upper Variation	+ 0.3	+ 0.3	+ 0.4	+ 0.5
Lower Variation	0	0	0	0

6—As a guidance for the lower variations of the shafts, 30 *PE* may also be used up to 50 mm. ϕ, and 0.5 mm. for all sizes above 50 mm. ϕ, as shown in the following table:

Shaft Diameter	7 to 10	above 10 up to 18	above 18 up to 30	above 30
Upper Variation	0	0	0	0
Lower Variation	— 0.3	— 0.3	— 0.4	— 0.5

In case cold-drawn steel is used the drawing tolerance *C* for drawn material, according to DIN 669, should be used (commercial quality). The lower variation curves for such material (—15 *PE*) are indicated with dotted lines in Figs. 1 and 2.

7—Standard diameters should, as a rule, be used for the shafts and the clearances should be provided for in the bores (Fig. 1). If, however, no drawn material is to be considered, it is possible to use standard diameters for the bores and provide for the clearances in shaft dimensions.

April, 1923.

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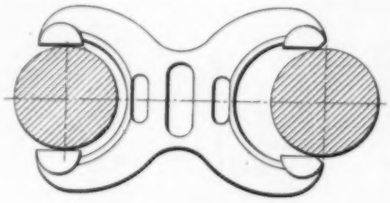
Pressitz
Fine Grade of Fit
Unit Bore System

DIN 54

Symbol for Pressitz: *P*

The "Pressitz" is used for parts which must remain tight under all conditions and which are fitted together by means of heavy pressure. Before a "Pressitz" is adopted it should be considered whether the maximum and minimum tightness (see columns 4 and 5) are suitable for the purpose and, if necessary, tests should be made to ascertain whether the fit suits the requirements. The strength of the union depends on the shape and material of the parts. For certain press fits for heavy machinery a greater tightness is desirable.

"Go" end
The weight of the gage shall suffice to force it over the shaft.



"No Go" end
It must not be possible to push the gage over the shaft. It must at the most stick to the shaft.

Dimensions in Millimeters

Range of Diameters	New Gage Variations		Calculated Tightness For New Gages.[1]		Worn Gage "Go" End		Kind of Gage
	Upper "Go" End	Lower "No Go" End	Minimum	Maximum	Permissible Wear	Variation	
1 to 3	+0.015	+0.010	0.001	0.015	0.0015	+0.0165	Snap Gage
Above 3 up to 6	+0.022	+0.015	0.003	0.022	0.0020	+0.024	
Above 6 up to 10	+0.030	+0.020	0.005	0.030	0.0025	+0.0325	
Above 10 up to 18	+0.038	+0.025	0.007	0.038	0.0030	+0.041	
Above 18 up to 30	+0.045	+0.032	0.010	0.045	0.0040	+0.049	
Above 30 up to 50	+0.060	+0.040	0.015	0.060	0.0045	+0.0645	
Above 50 up to 80	+0.075	+0.055	0.025	0.075	0.0050	+0.080	
Above 80 up to 120	+0.090	+0.065	0.030	0.090	0.0060	+0.096	
Above 120 up to 180	+0.105	+0.080	0.040	0.105	0.0070	+0.112	
Above 180 up to 260	+0.130	+0.100	0.055	0.130	0.0080	+0.138	
Above 260 up to 360	+0.155	+0.120	0.070	0.155	0.0090	+0.164	
Above 360 up to 500	+0.180	+0.140	0.080	0.180	0.0100	+0.190	

[1] Corresponding bore: *B* according to DIN 19.
Standard Temperature: 20 deg. *C* = 68 deg. *F*.

March, 1923.

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system in some cases of heavy machine construction, for certain kinds of electrical apparatus, etc. Up to the present time it has been adopted by the transmision machinery and the textile machine builders. Many efforts have been made by German experts to combine the advantages of the unit bore and the unit shaft systems, in order to obtain *one* universally acceptable system. The most noteworthy of such combinations is the one proposed by Gottwein. He uses the Gleitsitz, in which the unit bore matches with the unit shaft as a bridge between the two systems. For all fits, looser than the Gleitsitz, he used the unit shaft and for all fits tighter than the Gleitsitz, he uses the unit bore system. While this system in some cases is preferable to the ones mentioned, it does not fully utilize the advantages of either and has, therefore, not been found worthy to take their place.

Regarding other suggestions, we refer to the above DINBUCH No. 4, Passungen, by Wm. Gramenz, Chief Engineer, Dinorm, Berlin.

It may be of interest to note that, after careful consideration, *one* of the two larger electrical manufacturers in Germany has adopted the unit bore system, while the other has adopted the unit shaft system, and each seems to have made the proper selection. The difference in opinion is due to the fact that one of the firms manufactures very large quantities in certain lines of machinery, while the other excels in a somewhat different line.

In order to obtain economical production it is, of course, of the greatest importance that the grade and class of each fit be properly selected. These selections require, however, considerable knowledge of tolerance questions and, in order to assist the manufacturer, recommendations of suitable fits for a number of typical applications have been published in the DINBUCH. These recommendations go further into details than those published up to the present time by the A.S.M.E. Plain Gages Committee (see *American Machinist*, page 71, Vol. 57), but it is nevertheless expected that the specialists in each line will have to co-operate in order to establish and standardize on the most suitable fits for all important applications.

The extra fine grade of fits (Edelpassung) is only used for the Festsitz, Treibsitz, Haftsitz, Schiebesitz and Gleitsitz and only in cases where severe requirements are made as to the uniformity of the product.

The fine grade of fits (Feinpassung) is used for all classes of fits and is sufficient for all normal requirements.

The following examples illustrate the use of the various classes of fits in the above two grades:

Pressitz (*P*), is used in general machine design for bronze rims on cast-iron gears and worm gears, bushings or bearings in frames, housings, gear wheels and connecting rods, and for couplings.

Festsitz (*eF* and *F*), is used in machine-tool design for wheel rims, bearing bushings, hubs, stop rings, etc. In automotive construction, for bushings in wheel-hubs. In reciprocating-engine design, for cranks and levers on shafts, when Pressitz cannot be used, and for cylinder linings. In general machine design, for inserted pivots in rolls, worm gears, all parts which have to sustain shocks while in operation, such as gears in crushers (when Pressitz cannot be used), wheels of industrial trucks, railway motor gears, etc.

Treibsitz (*eT* and *T*), is used in machine-tool design,

for gears, which must be removable (Festsitz therefore unsuitable), but must fit tight on the shaft. Such gears must be locked on the shaft.

Haftsitz (*eH* and *H*), is used in machine-tool design, for parts which are held with keys and seldom removed, gears on lathe spindles, clutch disks, hand wheels, etc. In automotive construction for levers and gears on their shafts, when their removal by primitive means must be possible. In reciprocating-engine design, for gears, cams and eccentrics for the operation of regulators and valves and on cams or crankshafts, flywheels, etc. In general machine design, for turbo-runners, clutches, gear wheels, brake disks, tight pulleys, flywheels, cranks for light duty, driving and driven parts in general (when they are mounted at the end of a shaft and a tighter fit is not necessary), electrical armatures, packing-box linings, hardened bushings for valve levers and the like.

Schiebesitz (*eS* and *S*), is used in machine-tool design, for parts which frequently have to be removed, stationary axles in their seats, etc. In reciprocating-engine design, for the cylindrical offset of the piston rod in the crosshead, fork pins in the valve gear, etc. In general machine design, for centrifugal runners on their shafts.

Gleitsitz (*eG* and *G*), in machine-tool design, for center pins in tail stocks of lathes, column guides of radial drilling machines, chucks on drill spindles, speed-changing gears on their shafts, mills on their seats, handles in hand wheels, index pivots in dividing heads, etc. In reciprocating-engine design, for all parts requiring a "sucking fit," such as pistons for oil brakes. In general machine design, for clutch disks, friction clutches on their shafts and the like.

Enger Laufsitz (*EL*), is used in machine-tool design, for idlers, spindle bearings for grinding machines, speed change-gears, etc. In reciprocating-engine design, for wristpin bearings, valve stems, indicator pistons, etc. In regulator design, for pistons for various purposes. In general machine design, for sliding couplings.

Laufsitz (*L*), is used in machine-tool design, for bearings for high-grade drive shafts, main bearings for lathes, milling and drilling machines. In automotive construction, for bushings and bearings for cardan, crank, and camshafts and for connecting rods. In regulator design for all bearings on revolving weights, sleeves on shaft, guides, etc. In general machine design, for use in bearings in transmissions and in worm gear boxes.

Leichter Laufsitz (*LL*), is used in machine-tool design, for feed screws, for tool holders and for shafts supported in many bearings.

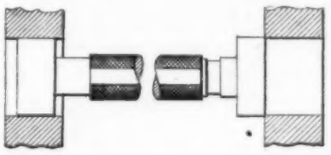
Pressitz
Fine Grade of Fit
Unit Shaft System

DIN 55

Symbol for Pressitz: *P*

The "Pressitz" is used for parts which must remain tight under all conditions and which are fitted together by means of heavy pressure. Before a "Pressitz" is adopted it should be considered whether the maximum and minimum tightness (see columns 4 and 5) are suitable for the purpose and, if necessary, tests should be made to ascertain whether the fit suits the requirements. The strength of the union depends on the shape and material of the parts. For certain press fits for heavy machinery a greater tightness is desirable.

"Go" end
The gage shall enter the hole without being forced.



"No Go" end
It must not be possible to push the gage in. It must at the most stick at the opening.

Dimensions in Millimeters

Range of Diameters	New Gage Variations		Calculated Tightness For New Gages[1]		Worn Gage "Go" End		Kind of Gage
	Upper "Go" End	Lower "No Go" End	Minimum	Maximum	Permissible Wear	Variation	
1 to 3	—0.007	—0.015	0.001	0.015	0.0020	—0.017	Up to 100 mm. Plug Gage
Above 3 up to 6	—0.010	—0.022	0.002	0.022	0.0030	—0.025	
Above 6 up to 10	—0.015	—0.030	0.005	0.030	0.0035	—0.0335	
Above 10 up to 18	—0.020	—0.038	0.008	0.038	0.0040	—0.042	
Above 18 up to 30	—0.025	—0.045	0.010	0.045	0.0050	—0.050	
Above 30 up to 50	—0.035	—0.060	0.017	0.060	0.0060	—0.066	
Above 50 up to 80	—0.045	—0.075	0.025	0.075	0.0070	—0.082	
Above 80 up to 120	—0.055	—0.090	0.033	0.090	0.0080	—0.098	Above 100 mm. Flat Gage
Above 120 up to 180	—0.065	—0.105	0.040	0.105	0.0090	—0.114	
Above 180 up to 260	—0.085	—0.130	0.055	0.130	0.0100	—0.140	
Above 260 up to 360	—0.105	—0.155	0.070	0.155	0.0120	—0.167	Ball end Gage[2]
Above 360 up to 500	—0.120	—0.180	0.080	0.180	0.0140	—0.194	

[1] Corresponding shaft: *W* according to DIN 40.
[2] When flat or ball end gages are used somewhat tighter fits are at times obtained than with plug gages.
Standard Temperature: 20 deg. *C* = 68 deg. *F*.

March, 1923.

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Weiter Laufsitz (*WL*), is used in general machine design, for high grade transmissions and countershafts, high-speed machinery and in special cases, where a loose fit of great exactness is required.

Plain Grade of Fits (Schlichtpassung) is used in cases where the requirements in regard to uniformity of the fits are not very severe.

Schlichtgleitsitz (*sG*), is used in general machine design, for bores for stop rings, hand cranks, gear wheels, solid pulleys, couplings, etc., which have to be pushed over the shaft.

Schlichtlaufsitz (*sL*), is used in automotive construction, for hub bushings for front wheels. In reciprocating-engine design, for main bearings for crank shafts,

Tolerances for the Adjustment of Working Gages[1]

DIN 168

For limit gages the following tolerances from the ideal dimensions[2] are permitted:

1—The "Go" end shall have a unilateral tolerance in the direction opposite the wear, thus:

a—A positive tolerance in case of Plug, Flat and Ball-End Gages.

b—A negative tolerance in the case of Snap Gages.

2—The "No Go" end shall, in view of the negligible wear, have symmetrical bilateral tolerances, the total tolerance for the adjustment of the gage being the same as for the "Go" end.

u (1u = 1/1000 mm.)

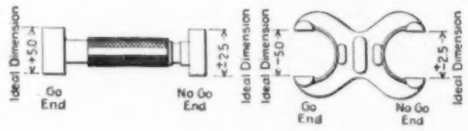
Range of Diameters in mm. Basic Sizes	Tolerances in case of Extra Fine Grade of Fit				Fine Grade of Fit			
	Plug, Flat and Ball End Gages		Snap Gages		Plug, Flat and Ball End Gages		Snap Gages	
	"Go" End	"No Go" End	"Go" End	"No Go" End	"Go" End	"No Go" End	"Go" End	"No Go" End
1 up to 3	+1.5	±0.8	—2.5	±1.3	+ 2.5	± 1.3	— 2.5	± 1.3
Above 3 up to 6	+1.5	±0.8	—3.0	±1.5	+ 3.0	± 1.5	— 3.0	± 1.5
Above 6 up to 10	+2.0	±1.0	—4.0	±2.0	+ 4.0	± 2.0	— 4.0	± 2.0
Above 10 up to 30	+2.5	±1.3	—4.5	±2.3	+ 4.5	± 2.3	— 4.5	± 2.3
Above 30 up to 50	+3.0	±1.5	—5.0	±2.5	+ 5.0	± 2.5	— 5.0	± 2.5
Above 50 up to 80	+3.5	±1.8	—6.5	±3.3	+ 6.5	± 3.3	— 6.5	± 3.3
Above 80 up to 120	+4.5	±2.3	—8.5	±4.3	+ 8.5	± 4.3	— 8.5	± 4.3
Above 120 up to 180					+10.0	± 5.0	—10.0	± 5.0
Above 180 up to 260					+12.0	± 6.0	—12.0	± 6.0
Above 260 up to 360					+16.0	± 8.0	—16.0	± 8.0
Above 360 up to 430					+18.0	± 9.0	—18.0	± 9.0
Above 430 up to 500					+20.0	±10.0	—20.0	± 10.0

Din 168—Continued

Range of Diameters in mm. Basic Sizes	Tolerances in case of Plain Grade of Fit				Coarse Grade of Fit			
	Plug, Flat and Ball End Gages		Snap Gages		Plug, Flat and Ball End Gages		Snap Gages	
	"Go" End	"No Go" End	"Go" End	"No Go" End	"Go" End	"No Go" End	"Go" End	"No Go" End
1 up to 3	+ 6	±3	— 6	±3	+10	± 5	—10	± 5
Above 3 up to 6	+ 6	±3	— 6	±3	+10	± 5	—10	± 5
Above 6 up to 10	+ 6	±3	— 6	±3	+10	± 5	—10	± 5
Above 10 up to 30	+ 7	±3.5	— 7	±3.5	+12	± 6	—12	± 6
Above 30 up to 50	+ 8	±4	— 8	±4	+12	± 6	—12	± 6
Above 50 up to 80	+10	±5	—10	±5	+14	± 7	—14	± 7
Above 80 up to 120	+12	±6	—12	±6	+18	± 9	—18	± 9
Above 120 up to 180	+14	±7	—14	±7	+22	±11	—22	±11
Above 180 up to 260	+18	±9	—18	±9	+28	±14	—28	±14
Above 260 up to 360	+22	±11	—22	±11	+36	±18	—36	±18
Above 360 up to 430	+26	±13	—26	±13	+44	±22	—44	±22
Above 430 up to 500	+30	±15	—30	±15	+50	±25	—50	±25

[1] Tolerances for the adjustment of inspection gages see DIN 171.
[2] Ideal dimension = basic size + (or —) variation.

Example for the range of diameters 30 to 50 mm. Fine grade of fit.



April, 1923. 2 (corrected) issue.

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connecting-rod bearings, crosshead guides, piston-rod guides, slide-valve rods, valve stems for combustion engines, shafts running in three bearings or subject to high temperature, pistons and piston valves in their cylinders, plungers in bushings and eccentrics. In general machine design, for bearings for dynamos, rolls, centrifugal pumps, ventilator shafts, loose rope wheels, packing box glands, sliding sleeves for couplings, etc. In locomotive construction, for wrist pins for valve rod crossheads.

Weiter Schlichtlaufsitz (*sWL*), in automotive construction for bearings for motor plows. In general machine design, for hub bushings for animal-drawn vehicles, bearings for agricultural machinery, transmission bearings. In locomotive construction, for centering of cylinder and valve box heads, packing box parts, width of piston rings and pivots of the reversing gear.

Rough Grade of Fits (Grobpassung), is used in cases where loose fits and great variations in dimensions are permissible, or where the fits have to be very loose in order to prevent the formation of rust to make the fit tight.

Grobsitz (*g1*), is used in general machine design, distance sleeves and parts which are stuck together in order to be welded. In mechanical apparatus construction, for bearings for lever switches, bores in hand levers and typewriter parts. In locomotive construction, for valve rod guides.

Grobsitze (*g3*), is used in general machine design, for bearings for agricultural and household machinery. In automotive construction, for fork pins for brake gears. In mechanical apparatus design, for lock pins for switch levers, axle bearings for drum switches, piston contacts and sheet iron covers. In locomotive and car construction, for bolts in the regulator gears for locomotives, pivots, and buffer bases.

Grobsitz (*g4*), is used in locomotive and car construction, for regulator shafts for locomotives, smoke chamber doors, spring and brake suspensions, brake shafts, coupling bolts. In apparatus design, for sheet iron housings.

The Human Equation in Making Gears

MODERN business depends more upon men than upon dollars. Given the opportunity of investing in a business with abundantly strong financial resources but with questionable management, and a struggling business but with high grade and trained management, any intelligent man would take the latter as having the best chance for the future. In Europe where business is conservative and old standards are adhered to, initiative is not so important a factor; but in America, the land of opportunity, we find it also the land of the opportunist and the man who forges ahead rapidly is the man just one jump ahead of the rest, seeing things just a little bit sooner than his competitors, flexible in his mind and flexible in his organization so that he is able to keep apace with the swift moving trend of our modern American business. No one man can provide all of the ideas or all of the advancements necessary for an industry and if he is able to thoroughly organize his industry from top to bottom with sympathetic, alert co-operation from each and every employee, he has to a large degree solved his problem of personnel. Ways and means to accomplish this should be the primary function of any industrial relations committee.

We have heard a great deal about the open and closed shops and about wages paid in the industry. Any man who is at all a student of economics knows the hardships and inefficiencies brought about when a shop is thoroughly unionized. It should not be necessary for a committee to suggest the answer to this problem. On the other hand, there are some industries and some localities that have inherited a policy that they cannot change and we believe it most desirable that they seek for the largest measure of constructive suggestions that shall enable them to live as far as possible in peace and harmony with their own situation.

After having carefully studied a very large number of wage questionnaires sent out by manufacturing associations, the writer feels that this is a field so thoroughly covered that the A.G.M.A. need not attempt duplication. After all these are local problems fixed by living conditions and wage conditions in each separate locality and in each separate shop. With a varying system of premiums, wage incentives, and similar extra payments, with an impossible classification of men working in various shops and on various qualities of work, we feel that the value of the questionnaire is exceedingly small in its practical standpoint.

Let us suggest then that we take our minds for a bit off these thoughts and deal with some of the other attributes of our industrial relations.

The Old Problem of Labor Turnover

Labor turnover costs far more than many of the slight variations in labor pays that worry us so much. Various estimates have been made as to the cost of breaking in a new man but even the lowest are staggering when we consider that many shops are absolutely heedless as to the change of men. It should be the function of the management to study their local conditions so carefully that their shop becomes a home for their employees and they cultivate their good will. No iron clad formula can be applied; in the small shops it is done by personal contact of the boss himself. In the larger shop it must necessarily be somewhat delegated. We believe, however, that under no circumstances can the right spirit be obtained if it does not very distinctly emanate from the head of the industry and if every member of the industry does not realize that the chief executive is interested in his employees and in their problems. Paternalism in the industry has been often condemned, yet the fact remains that the industries where the greatest loyalty is felt and where labor turnover runs lowest are those where the head is looked upon as the big daddy of the whole bunch. A good bouquet of flowers when an employee is sick or when a baby comes into the home will often do more to cement good will in the industry than many of our elaborate efforts through bulletin boards and pay roll inserts, but lacking in personal touch.

The future of America as a nation requires that every effort be put forth by the employer of today to help employees to think right. Tremendous agitation is seething throughout the country, prompted by European

Abstract of report of E. S. Sawtelle, Chairman of the Committee on Industrial Relations, to the American Gear Manufacturers Association, Fall Meeting, October, 1923.

experiments in Bolshevism or Communism. Organized labor is frequently asserting that it is the bulwark of safety against such agitation and many employers are misled through these claims. Actual facts usually demonstrate that the organizers are perfectly willing to draw into their ranks any agitator whatever if they feel that by so doing they can strengthen themselves in their craft. The surest safeguard against radical socialism is for a man to own something. The next best is for him to have a right viewpoint toward the other fellow who owns more than he does. Stock ownership properly safeguarded is a step toward larger democracy. Profit-sharing through wage incentives, production bonuses, or an actual sharing of profits, if it carries with it the personal touch of management, can be used very effectively in reducing labor turnover and in creating an organization that builds still greater profit. Above all these is the influence of a clean-living employer who does not flash his wealth before his employees and who is willing to give of his time to know his men personally as far as possible and to frequently talk with them individually and collectively about the mutual problems of their business or their personal lives. This was the secret of the old-fashioned little shop where the boss worked in with his men. It is the secret of our large shops where success in personnel has been accomplished.

Your committee feels that time can well be spent in studying reports on the various types of wage incentives and how they can be applied and the benefit obtained thereby. We feel that suggestions and experience on the question of training workmen and foremen will be of value; we feel that suggestions on managerial contact with men and welfare work are well worth careful consideration; despite the old adage that religion and business do not mix, we feel that a certain amount of religious influence has proved wonderfully successful in many shops toward building character in the workmen and promoting the ideal spirit of co-operation.

Certain companies have made spectacular progress along welfare and kindred lines and have stood as an example of leadership for their industries. We propose to investigate some of these and attempt to bring before our association some of the plans that they have successfully worked and the results to be obtained therefrom.

Again let us reiterate that no two personalities are the same, no two shops are the same, and that industrial relationship is 99 per cent a matter of applied personality. Hence this whole question is one that each man must solve for himself and we believe, as he approaches a solution, he will be working not only for the benefit of his own industry but for a more permanent stability of our whole nation.

Metal Cutting Tools—Discussion

BY R. POLIAKOFF

In his discussion of metal cutting tools on page 64, Vol. 59 of the *American Machinist*, F. W. Elstub mentions the hollow curved top face tool, and states that it has been proved to the satisfaction of many users that such tools absorb considerably less power than equivalent straight faced tools.

The question raised by Mr. Elstub deserves more than

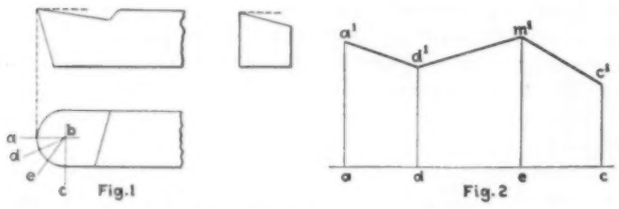


FIG. 1—THREE VIEWS OF A ROUND-EDGE TOOL. FIG. 2—CURVE SHOWING VARIATION OF CUTTING ANGLE

a passing remark and the writer discussed the same point with regard to a round nose tool about six years ago at a meeting of the American Society of Mechanical Engineers.

If we take the ordinary round-edge tool, as shown in Fig. 1, with the ordinary angles of front rake, side rake and clearance, we shall find by a very simple mathematical analysis that when the front rake is less than the side rake, as it usually is, the cutting angle changes from point to point of the edge. Let us assume that the chip and all its elements go off the point. The angle will have one value at the plane *ab*, the plane of the front rake, a lesser value at the plane *bc*, side rake, and intermediate values at intermediate points.

If we lay off the respective values of the cutting angles at the corresponding different points *a*, *d*, *e*, *c*, of the cutting edge, then these values would change like the curve *a'*, *d'*, *m'*, *c'*, as shown in Fig. 2. In other words, the angle will first decrease, then go up a little, then decrease again until it reaches the lesser value *cc'*, corresponding to the plane *bc*. These angles, with an ordinary round-edge tool and the usually accepted angles of side and front rake, therefore change in a curve with some peak points in it.

FRICTION OF ELEMENTARY CHIPS

If we assume that the chip consists of elementary chips, each element going off the bar at right angles to the cutting edge, then these different elementary chips have to descend on inclined planes with changing angles, and necessarily one elementary chip is either retarded or accelerated in its downward movement by its adjoining chip. This retardation or acceleration must create inner friction and cause scratches on the hollow of the tool, every single scratch being the mark left by the elementary chip.

It is evident that in order to decrease this friction and thus the power required to remove the chip, as well as to prolong the life of the tool by eliminating the scratches produced by the elementary chips, the tool should be of such a shape that all its cutting edges are equal at all points of the cutting edge.

In order to achieve this end, the surface inclosed by quadrant *adec*, Fig. 1, should not be a plane but hollowed out by a drill with its center point at *b* and having a radius *ab*, equal to *bc*, and its cylindrical body perpendicular to the plane of the quadrant. In this way all the cutting angles would be equal all the way through from *a* to *c* just as in the case of a straight-edge tool.

Of course, this calls for another way of preparing the turning tool, both with regard to machining and grinding, but this can be arranged. The writer introduced such a tool in the Laboratory of Technology at the Technical Institute, Moscow, Russia, and has also designed some grinding attachments to grind the hollow produced by the drill.

Wage-Incentive Systems

By EUGENE BOUTON

Group piece-work plan for major assembly units and machining departments — Workman's wages determined by total group earnings — Unit costs kept uniform — Prompt wage records

WAGE-INCENTIVE systems constitute one of the important problems of the industrial world. Many writers on wage systems, management and personnel administration cover their systems very well; but their articles are largely lacking in statistical information. In modern industry, the unit-cost of production is an important factor. It does not matter how much a man receives per hour or per day if his output is in proportion to his wages. There are many plants that are so well organized that they pay high wages and yet have a low production-cost, while other plants more poorly organized have a high unit-cost of production in spite of the fact that they are paying low wages.

Practically all managers of modern plants believe that some wage-incentive plan is necessary to attain the highest production possible. The subject of most discussions ragarding wage-incentive plans is: What is the proper system to install? Many men state that standard time is the best, while it is claimed by others that straight piece-work, group-bonus, premium and the like are much better. It would be interesting indeed to survey all the plants in the automotive industry to determine what wage-incentive systems are in use, to tabulate them in divisions, and thus show exactly which systems are most favored. Some of the systems now in use are highly complicated and involve a large amount of clerical work and maintenance expense. Using such systems, the employer does not know with certainty in advance just what the direct labor-cost will be, nor does the employee know what his earnings will amount to in a pay-period. As a rule, costs and earnings are compiled at the end of a pay-period or of every month.

No Universal Plan

Manufacturing conditions, as well as the manufacturing processes in the departments of a large plant, vary considerably and cause entirely different problems to arise. Therefore, a single wage-incentive plan which will fit all departments in an automobile plant satisfactorily is yet to be evolved. The straight piece-work system has been criticized severely by both employer and employe, sometimes unjustly because of the application of piece-work to operations which do not lend themselves to this form of wage-incentive. When the correct and applicable system is used, the opposition of labor is reduced to the minimum. However, there are many operations in connection with which straight piece-work is perhaps the best incentive-plan to apply. The same is true of other forms of wage-payment plans whenever one particular system is used throughout a factory.

A paper presented at the Production Meeting of the Society of Automotive Engineers, Cleveland, Ohio, Oct. 25, 1923.

The company I represent has adopted the group piece-work plan for the major assembly units and machining departments, a sample form being shown in Fig. 1 Straight individual piece-work, a record form for which is shown in Fig. 2 is used for small parts on which the operations do not lend themselves very readily to group piece-work and which are, in fact, apart from any group of men or operations which involve only one,

GROUP PIECE WORK

OPERATION AND ROUTING SHEET

Date 6-6-23 Group No. 108

Part Name INTAKE & EXHAUST MANIFOLD ASSEMBLY Part No. 7108

Material Cast Iron Model 32 Req. per car 1 Sheet No. 1

OPER No.	OPERATION	PRICE	HRLY PROD	TOOL No.	TOOLS OR EQUIPMENT
1	The following operations on Part No. 7109, Exhaust Manifold, No. 7115 Intake Manifold and the Manifold Assembly to be worked as a group for the price per completed Manifold as shown:-	———	1.14		(See Below)
	Part No. 7109.				
	a. Bore exhaust end		18.6	700	Cincinnati Drill Holding Fixture
	b. Mill flanges		7.1	125	Brown & Sharpe Mill Double Mill Fixture
	c. Mill face pad		7.75	101	#3 Cincinnati Mill Double Mill Fixture
	d. Drill (7) 17/64" holes		23.1	38	Colburn Drill Press Drill Jig
	e. Mill air pad		21.6	249	#2 Cincinnati Mill Milling Fixture
	f. Drill & tap (4) 5/16"-18air pad holes for cover		22.9	273	Hammond Radial Drill Holding Fixture Drill Jig
	g. Tap (7) 5/16"-18 face pad holes and drill for & tap (2) 5/16"-18 exhaust flange holes		21.6	322	Hammond Radial Drill (2) Holding Fixtures (1) Drill template
	Part No. 7115.				
	a. Mill flanges		7.1	125	Brown & Sharpe Mill Double Mill Fixture
	b. Mill face pad		7.75	101	#3 Cincinnati Mill Double Mill Fixture
	c. Drill (6) 11/32" face pad holes		22.6	38	Colburn Drill Press Drill Jig.
	d. Spotface (7) bolt hole bosses		35.1	123	Cincinnati Drill Press Holding Fixture
	Manifold Assembly				
	a. Assembly intake & exhaust manifolds		6.15		Assembly Bench Holding Fixture
	b. Drill (10) 13/32" and (8) 9/16" flange holes.		19.8	119	Natco Multiple Drill Indexing Fixture
	c. Mill carburetor pad		22.9	315	#3 Cincinnati Mill Holding Fixture
	d. Drill (2) 25/64" holes for carbureter bolts and chamfer intake ports		16.9	133	Cincinnati Drill Holding Fixture

Remarks All operations to be worked as a group and the total earnings pro-rated among the number of men working in the group in proportion to their hourly rates. Approved

FIG. 1—OPERATION AND ROUTING SHEET FOR GROUP PIECE-WORK

two or three operations to complete the part. The piece-work prices are established from data obtained in an elemental time-study. The time-study record is shown in Fig. 3.

The group piece-work plan is fundamentally the same as straight piece-work. A time-study of all the operations in the entire group is taken, reasonable allowances for fatigue, tools and contingencies are made, and the price is set based on the additive time. The group earnings are derived from the number of accepted finished units multiplied by the unit price. The indi-

vidual workman's earnings are prorated out of the group earnings based on his hourly rate and the number of hours worked. A simple method of figuring the individual earnings is that: The total group piece-work earnings divided by the total day-rate earnings of the group equals the factor by which is multiplied the workmen's day-rate earnings; this gives his prorated piece-work amount. Thus,

$$W = T/D \times H \times R$$

H = Hours worked
R = Hourly rate
T = Total group-earnings
D = Total group hourly-rate
W = Employee's total earnings

One of the important factors in the successful operation of the group plan is the differentiation of hourly rates. The most careful judgment should be exercised in rating the men according to their ability and to the skill required to perform the respective operations. All unskilled operators, including new men, should receive the minimum hourly-rate; skilled and semi-skilled workmen should be rated accordingly, above the minimum rate. Maximum and minimum hourly-rates are specified by the management and all rates must be within

INDIVIDUAL PIECE WORK

OPERATION AND ROUTING SHEET

Date 6-2-22

Part Name CRANKSHAFT BEARING CAP - FRONT Part No. 20128

Material Aluminum Model 32 Req. per car 1 Sheet No. 1

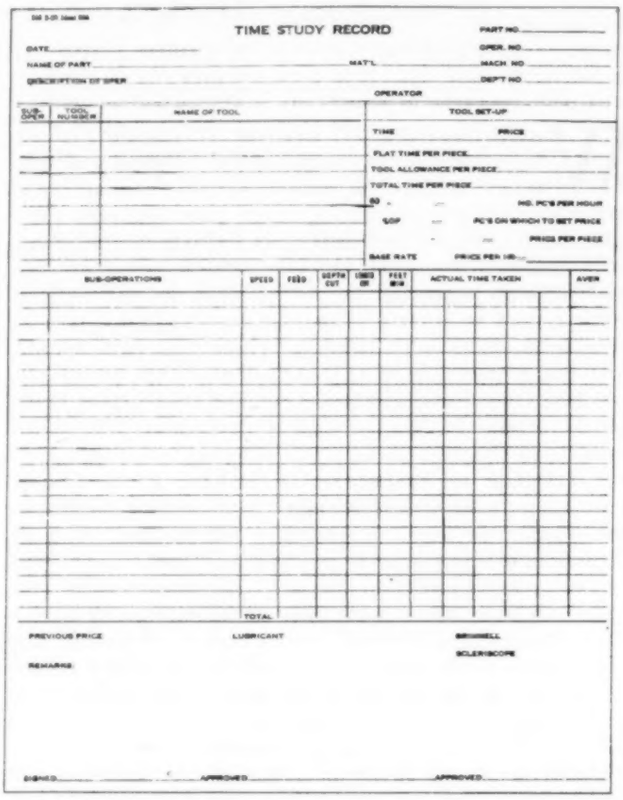
OPER No.	OPERATION	PRICE	HRLY PROD.	TOOL No.	TOOLS OR EQUIPMENT
1	Mill bottom surface	.0080	68	22	Cinn. Vertical Mill Milling Fixture
2	Drill (4) stud holes	.0130	47.4	120	Baton Multi. Drill Drilling Fixture
3	Ream (4) stud holes	.0077	83.2	868	Canady Otto Drill Press
4	Spotface (4) stud holes	.0093	70	866	Canady Otto Drill Press

Remarks Supersedes sheet dated 4-27-22 Approved

FIG. 2—OPERATION AND ROUTING SHEET FOR INDIVIDUAL PIECE-WORK

those specified. If a workman requests an increase in hourly rates, and the increase is favorably recommended by the department foreman, this can be granted without increasing the cost of the unit, as the workman simply receives a higher pro-rated share of the total group-earnings. This has been an important and satisfactory factor in the revision of rates, and balances better the earnings of the various operators according to the work which they perform.

Another feature of the group piece-work plan is the immediate determination by the foreman of the number of men required to produce according to any given schedule of units. For example, if it requires 100 men to finish 100 units per day and the schedule of production should drop to 75, practically 75 men would be required to produce 75 units. However, if the schedule should drop to 50, it would, in actual practice, require a few more than 50 men, due to the fact that each workman would have to perform more operations and individual production would be limited for that reason.


TIME STUDY RECORD

DATE PART NO.
NAME OF PART MAT'L OPER. NO.
DESCRIPTION OF OPER MACH. NO.
DEPT NO.
OPERATOR

SUB-OPER'N | TOOL NO. OR SKETCH | NAME OF TOOL | TOOL SET-UP

TIME PRICE
FLAT TIME PER PIECE
TOOL ALLOWANCE PER PIECE
TOTAL TIME PER PIECE
60 — NO. PC'S PER HOUR
%OP — PC'S ON WHICH TO SET PRICE
— PRICE PER PIECE
BASE RATE PRICE PER HR.

SUB-OPERATIONS	SPEED	FEED	DEPTH CUT	USED ON	FEET MIN	ACTUAL TIME TAKEN	AVER
TOTAL							

PREVIOUS PRICE LUBRICANT BRINELL SCLEROSCOPE

REMARKS

SIGNED APPROVED APPROVED

FIG. 3—TIME STUDY RECORD

Likewise, when the schedule of production is increased, say to 150 units per day, it would not require 50 additional men in actual practice.

The group or cost price of each unit should be based on a schedule as nearly uniform as it is possible to set, and a slight fluctuation either upward or downward would not affect the price. Any wide variation in production would tend to change the original rate, and necessitate a slight change in the piece-work price of the unit. Little has been said by others about this feature of group work, but it is a factor to be reckoned with at certain times of the year when production fluctuates. However, how far from the original schedule we can go, either upward or downward, before the price is affected, is to be determined in any individual plant wherever the group prices are established.

When a new employee is added to the group, he can be allowed to work in the group two days at his regular day-rate before participating in the group earnings. After that period he is prorated among the group. Should the new employee be too slow, or not satisfactory to the rest of the group, he is taken out. In this way the company bears a portion of the expense of breaking in the new man, and so does the group. At our plant, as a rule, when a new employee is put into the group, he

is started off at the group price. In cases where the labor turnover would be exceedingly high for a short period, one way to handle the new employee is to place him on his hourly day-rate for a period of 2 or 3 days and deduct this amount from the group earnings; but, as stated previously, we have never had to apply this feature.

The employees are desirous of earning as much money as possible; therefore, their interest in the group is also to keep the number of employees down to the minimum. The spirit of teamwork is developed in each group, and the inefficient workers are eliminated by the other group-workers; this relieves the foreman to some extent of this phase of supervision.

An inspector's coupon is made out by the inspection department. It shows the number of units completed daily in each group, and the quantity OK'ed and rejected; and is turned into the time-keeping office not later than 8 a.m. the following day. From this inspector's coupon the time-keeping department makes up a group piece-work report showing all of the employees in the group, the number of hours worked and the group number to which the workman is assigned; the employee merely rings "in" and "out" upon entering and leaving the factory.

The question often arises as to the proper size of a group. We have found that the group should be limited to the unit itself. There should be no more than one group on any one unit. We have in operation one group of 92 men, and one group of 83 men; the smaller groups run as low as 3 men. Other groups are of 10, 15 and 20 men. Each group of men completes one unit. By having the group gaged according to the unit, there is no tendency for any of the prices or for production to be out of balance. For example, if two groups were engaged in one unit, one group might be short 2 or 3 men and not be able to furnish the second group with enough units to keep its men busy; the latter would be limited to what the first group produced; but, by having all in one group, the production would be balanced to suit the number of men engaged. There is a limit perhaps to the size of a group, but we have yet to find what the high limit is.

Whenever parts needed by a group-unit are required

GROUP PIECE WORK REPORT

NAME OF GROUP OR PART Cylinder Blocks PART NO. 651 GROUP NO. 102 PG. 1 OF 1 PGS. DATE 10-1-23

	CLOCK NO.	PIECE WORK GROUP P. W. Hrs.	Rate	Amt.	Extras	TOTAL	OTHER P. W. Refer.	Hrs.	Amt.	Refer.	Hrs.	Amt.	TOTAL P. W	DAY WORK REFER	HOURS Reg	Spec	Tot	Day Rate	AMT	REFER	HOURS Reg	Spec	Tot	AMT	TOTAL D. W. HOURS	TOTAL ACTUAL HOURS
1	565	9	.50	4.50	1.635	7.36																				9
2	597	9	.60	5.40		8.73																				9
3	679	9	.60	4.50		7.36																				9
4	684	9	.55	4.95		8.09																				9
5	743	9	.50	4.50		7.36																				9
6	745	8½	.55	4.68		7.64																				8½
7	861	9	.50	4.50		7.36																				9
8																										
9																										
10																										
37																										
38																										
39																										
40																										
	TOTALS	62½		33.03		54.01																				62½

GROUP PRODUCTION

ITEM	Quan.	Rate	Amt.	Refer.
Cylinder Blocks	60	.90	54.00	A

GROUP CALCULATIONS

Total Earned $ 54.00
Less Extras
Balance
Total Group Hrs. 33.03
P. W. Hourly Rate 1.635

SUMMARY

ACCT.	Hrs.	Amt.

REMARKS

BY H.J.Z.
CHECKED BY CHH
Posted

FIG. 4—GROUP PIECE-WORK REPORT SHOWING INDIVIDUAL EARNINGS

amount earned according to their hourly day-rates; it is illustrated in Fig. 4. The report is made in quadruplicate; the first copy goes to the pay-roll department, the record to the time-study department, the third to the foreman of the department and the fourth copy is retained by the time-keeping department. The foreman of each department is enabled to know before 10 a.m. each day just what each individual's earnings were for the previous day. This feature of the group system is highly favored by the employees.

Some of our employees have worked on group systems in other plants, and could not be informed what their earnings were until the end of the pay-period. The ability to inform the employee on a given day what his earnings were on the previous day is one of the reasons the method described is favored by both the company I represent and its employees. If an employee quits or is discharged, we can calculate his pay from the number of units finished at any hour of the day, inasmuch as we know how many units have been completed up to that time.

The only time-card used is an in-and-out card showing the employee's attendance. The time-cards are stamped by the time-keeping department, indicating the

for service, the service department issues a requisition in duplicate, one copy of which goes to the time-keeping department as a check against the number of pieces withdrawn. For example, the service department may require 100 valve-lifter assemblies. The engine-assembly group assembles the valve lifters that are paid for at a certain price per piece, and the total earnings from these service parts assembled are added to the group earnings and prorated among the entire group. All piece prices covering service parts are established from the time studies made on the component parts of the group when the group unit is originally timed. Thus, with a flat price on any group, the management, the cost department and the employees know at all times what the price per unit is. There are no bonus nor premium calculations which in any way vary the costs.

Any increase in workmen's hourly-rates does not affect the cost, and the one thing that the employer wants to know with certainty at all times is just what the direct labor cost is. A definite understanding is had between the employer and the employees as to the amount of work to be produced for the compensation to be received. Failure of some systems to accomplish this has been the principal reason for objections to other wage-

incentive plans. Some of these systems are so complicated that the employee cannot understand them or figure his own wages; it is also necessary for the cost department to maintain a large clerical force to keep the proper records needed to secure costs. The costs so obtained are subject to fluctuations, and it is necessary to compile them for a period of from 6 to 12 months to obtain an average cost. It seems, then, that the ideal system is one which can be "sold" to the employer and the employee as well, and will tell at all times the definite work to be done and what the compensation therefor shall be. It appears that many systems have been wholly lacking in this respect, and are therefore undesirable in operation.

Our company and its employees feel that the group piece-work and the straight piece-work methods now in operation in our plant have met all of the principal objections generally experienced with other wage-incentive systems, and think that this system is satisfactory in every way.

Some Reminiscences

BY F. L. SYLVESTER

THE article by Ernest Jones in the *American Machinist*, page 456, Vol. 59, on a device for drawing an accurate spiral brings to mind some experiences of the writer back in the early eighties when serving as patternmaker's apprentice with the Boston Blower Co., an offshoot of the Sturtevant company, and long since, I believe, reabsorbed by that concern. Harvey, foreman of the pattern room, was a man of many peculiarities, but a genius in his way, nevertheless.

While I was with the company they made over most of their blower casing patterns with a view to getting them lighter. The outline of a blower casing is a spiral, and this outline the draftsman had laid out in the regular drafting room manner by working from four centers. Harvey ignored these centers entirely, and turning up a block of such a diameter as would give the proper circumference to agree to the increase of the spiral, mounted it in the middle of his work table. Then getting out a long strip of paper he attached one end to the block, and wound the rest of the strip around it. When a pencil had been attached to the free end of the paper he was ready, and by keeping the paper taut and unwinding it he was able to make a spiral which put the draftsman's in the shade. The advantage of using a strip of paper rather than a string to guide the pencil was, of course, that the paper would not stretch.

Harvey's real hobby, however, was lathe work. It was here that his genius especially showed itself. In its equipment the shop had a Blaisdel patternmaker's lathe with Fox tail stock, that is to say, it was made to be offset or swiveled or both, and it had both quick and screw feeds to the spindle. This lathe was the pride of Harvey's life. On it, with the work mounted on the tail stock, he would cut gears, cams, and almost anything that could be brought along. The tools which he used for the work were made of drill rod, the cutting end being flattened and bent outward somewhat. The tools were held in the headstock in a special holder like a lathe center with the projecting end made straight, the hole or socket in which the tools were held being lengthwise in the holder, but out of center. Then by revolving the tool in its socket more or less it would cut varying sizes. In doing such work he would, of course, have to go to considerable trouble to rig up a proper mounting to hold it, so that he did not always make a saving of time, though he would get accurate work. Such accuracy was not always required, however, especially where the castings were to be machined.

One of his hobbies, which he claimed was his invention, was a boring bar for working out core boxes. The principle of it was the same as the present core box machine, but this bar was used in the lathe and the box, with guides attached to the ends fitting over the bar, was held up to it. For much of the ordinary machine pattern work a core box plane would be quicker and good enough, but for brass work where the cost of the metal made close work desirable, and where not much finish was allowed, the boring bar was very serviceable, and its use was not limited to either straight or half core boxes. A core box having varying sizes in its length could be made of a single piece of stock, and whole core boxes, by having both pins on the same edge, could also be made.

Harvey is now gone, and the Boston Blower Co. is no more; but the principle of using one's head about his work remains the same.

Is Your Production Man Popular?—Discussion

BY W. W. LAWYER

The editorial on this subject on page 604 of the *American Machinist* brings out points that are worthy of careful thought. Is a production man human, actuated by similar ambitions and desires as other men? I have yet to come in contact with the man who desired unpopularity.

The arbitrator in a labor dispute by his decisions becomes popular or unpopular depending upon which side you are on.

Your picture of a production man, "the embodiment of a slide rule, a stop watch and a pad of paper," is well drawn alas in too many cases, for some employers seem to prefer young men with these qualifications only. If the results upon the workman from such treatment could be confined to the place of origin it would be a blessing to those employers who desire the confidence and co-operation of their help.

Memory seems to retain bad treatment longer than good, and confidence once destroyed is hard to reestablish.

Then there is another angle to this popularity, or lack of it. The management establishes what the hourly rates of pay shall be, likewise the premium or bonus earnings; and the man who sets the rates, times or tasks must do so in conformity with the policy of the management if he wishes to remain in their employ. He really is not the responsible party.

Now due to our economic conditions we all, whether employees or employers, seek to get for our product what we consider a fair return. But here is where the trouble begins, for as soon as some one tells us that 20 cents per hour and not $2 is fair or that 4 not 50 per cent profit is fair, they are not popular with us, for we know what is fair. Our self interest is much greater than our interest in others to such an extent that many are badly near-sighted, failing to see the inter-dependency of our social structure.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Simple Soldering Fixture

BY HARRY MOORE

It is seldom that a fixture is designed for a soldering operation and even more unusual that it originates in a small shop. But many times a better job can be done if a fixture is used. A case recently occurred where a number of brass sheet metal rings had to be butt-soldered to a central cross rod, the other end of the rod being also soldered to the ring.

The difficulty of this soldering operation will be seen

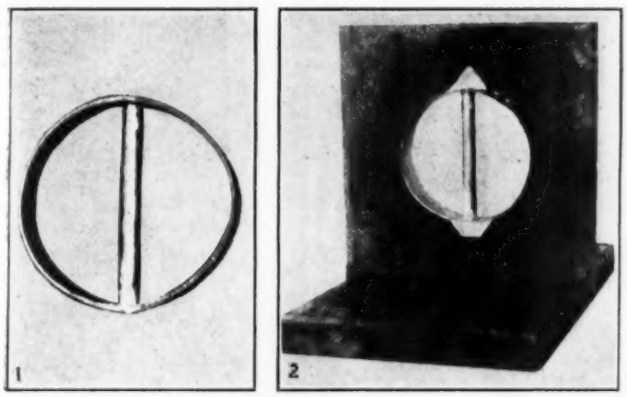


FIG. 1—A COMPLETED PIECE. FIG. 2—WORK IN THE FIXTURE

after a glance at the work shown in Fig. 1. Without some kind of fixture it would be a hard job closing the ends of the ring and holding them in contact while running a wall of solder round the cross piece and the joint.

With this difficulty in mind a square piece of sheet metal was cut out in the center the diameter of the finished rings and a V-shaped piece cut out on each side of the hole. A slab of metal was used for a base with a saw cut across it for holding the sheet metal as in Fig. 2. With this fixture the operation of soldering the ring was easily done.

The strip of sheet metal cut to proper length to form the ring was first curved and slipped in the hole in the holder where it assumed the proper shape, with the ends butting together. This joint was made to come at either side of the V's with the holder in the base so that the joint was at the bottom. The cross piece was next put in place with one end resting in the center of the joint. Then the center piece and both sides of the joint were tacked with solder. The holder was then turned over in the slot in the base and the other end of the rod tacked to the ring. With this done the lightly soldered ring was turned in the hole until the rod was in line with the V's.

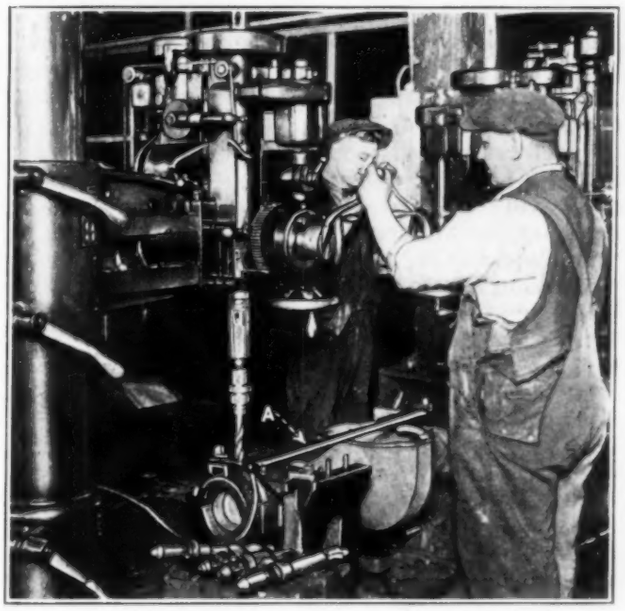
The final operation consists in running a wall of solder round each end of the rod, care being taken to melt the solder only on *one side* of the rod at the jointed end at a time. With a square sheet metal holder as shown the job could be instantly turned to any of the four positions required to complete the work.

The object of the cut out V's of course is to enable the work to be removed after soldering, the V's clearing any surplus solder on the outside of the ring.

Using Two Radial Drills at Once

BY H. E. CRAWFORD

The accompanying illustration shows the way in which the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., utilizes two radial drilling machines on the same job. These machines are located in the assembling



USING TWO RADIAL DRILLS AT ONCE

department for the axles and are drilling the holes at the ends for spring pads and brake attachments. The two machines are so placed that their arms will swing past each other, and this arrangement makes what is practically a two-spindle gang drill in which each spindle is adjustable, so as to cover any point within the range of the arms.

The use of two men in this manner makes it easy to handle comparatively heavy castings and to turn out a large number of axles per day.

The illustration gives an idea as to the construction of the fixture in which the housing is held and the way in which the bushing plates can be adjusted to meet different requirements. Center distances are controlled by the square bar *A*. This fixture handles a variety of sizes of axle housings, and the adjustable bushing plates make it easy to change from one size to the other.

Overhanging Gear Drives—Discussion

By R. Kraus

On page 525, Vol. 59, of the *American Machinist*, in an article under the title given above, J. T. Towlson shows some examples of overhanging gear drives and invites the criticisms of his fellow engineers.

A defect common to that shown in his Figs. 2 and 3 is the increased distance between bearings. A further disadvantage of the drive shown in Fig. 2 is that the device will lock itself after the bearings have become worn, while that shown in Fig. 3 will cause hot bearings at an early stage, for the reason that no means of adjustment is provided.

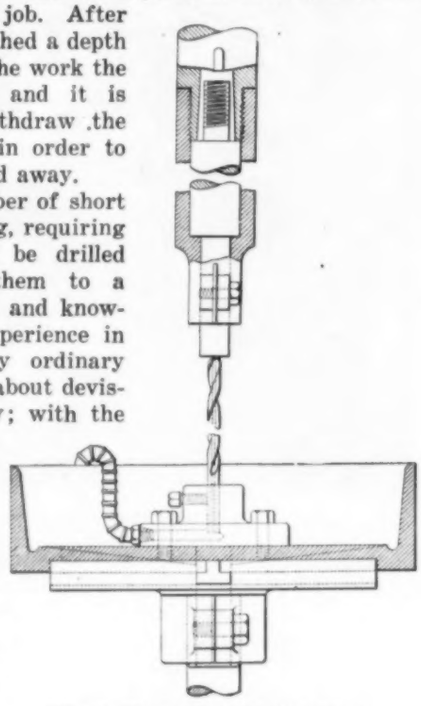
Back geared motor drives are very common, and the usual practice is to make the bearings as long as possible. Recessing them in the middle is to be recommended, for the reason that the bearing pressures are thus more equally distributed and at the same time a reservoir is provided for oil.

Drilling Deep Holes With a Vertical Drilling Machine

By J. A. Dalton

The drilling of deep holes of comparatively small diameter in a vertical drilling machine is, as every machinist who has had the experience knows, a tedious and aggravating job. After the drill has reached a depth of 2 or 3 in. in the work the chips will clog and it is necessary to withdraw the drill frequently in order to keep them cleared away.

Having a number of short shafts, 17 in. long, requiring a ½-in. hole to be drilled lengthwise in them to a depth of 13⅜ in., and knowing the usual experience in drilling them by ordinary methods, we set about devising a better way; with the result shown in the accompanying sketch.



DRILLING DEEP HOLES IN A VERTICAL DRILLING MACHINE

We first took out the machine spindle and threaded the lower end like the spindle nose of a lathe. To this thread we fitted a cast-iron sleeve, chambered out as shown to receive the shaft and split at the lower end to grip the shaft by means of a clamping collar and screw.

A ½-in. oil-tube drill, 15 in. long was then fitted to a pedestal so that it would stand upright on the machine table. We also made a cast-iron basin to fit over the table for the purpose of retaining the oil.

A passage drilled through the pedestal provided a means of getting oil to the drill, the oil being conveyed from a tank through a flexible tube. The pedestal was bolted in the center of the basin in line with the center of the machine spindle. Suitable channels cut in the bottom of the basin provided a means of egress for the oil through the central hole in the table to a receptacle beneath, from whence it was again transferred to the supply tank.

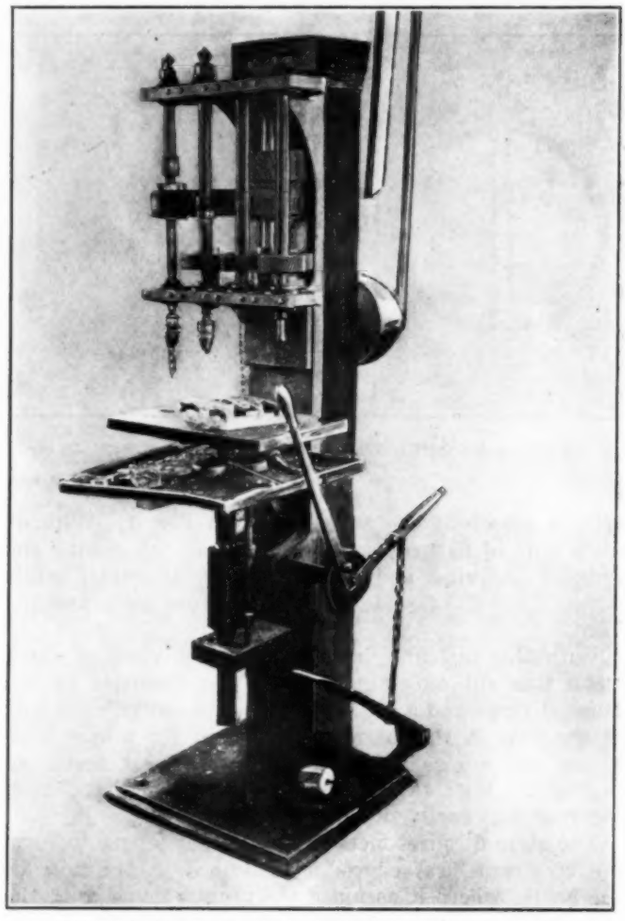
With this device and a copious flow of oil, the chips were washed away as fast as they were formed, and the time of drilling one shaft was cut from 45 min. to about 6 minutes.

A Patriarch Among Drill Presses

By John Williams

A drill-press that was designed and built during the civil war—and still in every day use, is shown in the accompanying illustration. Nor is it located in some backwoods shop where time is of little consequence, but in a factory where modern machinery is built.

The column is of cast iron, of box section, and was



DRILL-PRESS OF ANCIENT VINTAGE

evidently evolved by a designer who "guessed" it was heavy enough for the purpose; and he surely guessed right. The spindles have no vertical movement, as that is provided for by the table, which can be operated by hand lever or treadle as is most convenient. Note the means of increasing the "purchase" of the treadle as larger drills are used, by moving the link of the connecting chain a notch or two farther away from the center of the lever.

Probably the most notable feature of the machine is the helical gearing that drives three of the spindles.

I am of the opinion that the designer originally intended to drive all four of the spindles by belt, as the last one to the left is now driven, but having conceived the idea of helical (or "skew," as it was then called) gearing, or having seen a pair in operation, he was imbued with the desire to experiment.

One of the gears is keyed to the upright shaft behind the spindles, which shaft is driven by bevel gears in the usual manner and so located in regard to center distances that the driving gear clears all of the spindle gears. Two adjustable vertical studs, quite evidently an afterthought, are so placed as to take intermediate gears, one of which meshes with the driver and with two of the spindle gears while the other meshes only with the driver and the gear of the third spindle.

I am told that the designer made three or four sets of gears before he got a set that would run to his satisfaction, but that he finally did so is evidenced by the fact that the machine is still in use, driving modern high-speed drills at a rate that would have caused the old-time designer much consternation, and doing it with as little noise and fuss as if the gears had been cut on an up-to-date gear cutting machine.

Putting a Motor on the Ceiling—Discussion

BY MILTON WRIGHT

On page 527, Vol. 59, of the *American Machinist*, in an article under the title given above, I. B. Rich says that a "block and tackle doesn't help a bit" in putting a motor on the ceiling "as it cannot get the motor up to the ceiling and hold it there unless" etc., etc. Now I can say from my own experience that a block and tackle (which term I take to include a chain fall) *may* help a lot in doing this kind of a job if the conditions are right.

I have had occasion many times to swing up motors from 5 to 25 hp. for overhead attachment and unless the ceiling in question is the underside of the roof, or, if a floor, is covered at the place directly over where the motor is to be hung by immovable machinery or other fixtures, I proceed as follows:

A 2½- or 3-in. hole is first bored in the floor above as nearly over the center of gravity of the to-be-suspended motor as may be calculated and the chain fall is then hung from the overhead timbers or from a timber placed across a couple of tall horses so that the hook of the hoist chain is directly over the hole. A suitable sling is then passed through the hole in the floor and attached to the motor below.

A motor may be hoisted to place by this method with as little difficulty as if no floor intervened, except that it will probably be necessary to block it when part way up and take another hitch with the sling, as it is unlikely that there will be sufficient height between the floors above to permit the lift to be made in one hitch.

Most motors have a separate base of cast iron, and putting up such a motor is thus a two-part job. Though the base is not nearly so heavy as the motor it is still heavy enough—even in the fractional hp. sizes—so that a millwright cannot really enjoy standing on a ladder and holding it up with one hand while he drives the lag-bolts with the other. The hole in the floor can be plugged up, if desirable, in one-tenth of the time that would be required to put up and take down the necessary staging on the floor below.

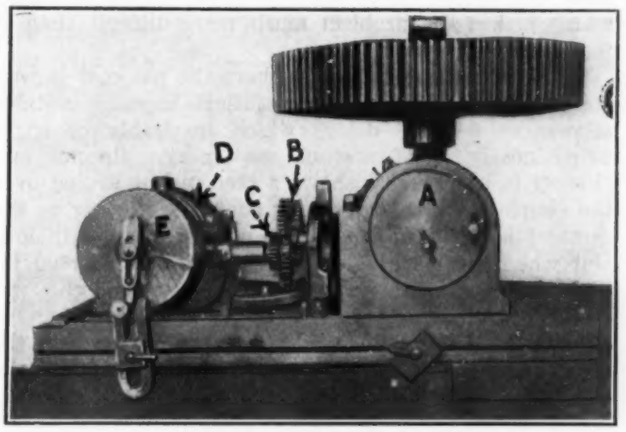
Indexing by Means of Two Dividing Heads

BY GEO. L. HICKAM

While rebuilding a 24 x 24 in. x 9 ft. Cincinnati planer in the shops of the Mechanical Engineering Department of Iowa State College, it became necessary to cut a 4-pitch, 91-tooth gear having a 4 in. face.

Our largest milling machine, a No. 3 Cincinnati, is not large enough to take a blank of this size mounted on a horizontal axis under the cutter, as is ordinarily done. We, therefore, held the blank in a horizontal position, as shown in the accompanying illustration. The work was then fed up against the cutter, the rim of the blank being supported by jacks placed under it.

We did not have the special indexing plate to suit the work, and owing to the position of the dividing head



TWO DIVIDING HEADS CONNECTED FOR INDEXING A GEAR

spindle, it was impossible to use differential indexing. However, we obtained the desired spacing by employing two dividing heads in the following manner. A standard No. 3 Cincinnati dividing head having a 40 to 1 ratio was employed. We then derived the formula:

$$\frac{40}{91} \times \frac{\text{No. of teeth in follower}}{\text{No. of teeth in driver}} \times \frac{\text{No. of holes in circle}}{\text{No. of spaces taken}}$$

$$= \frac{40}{91} \times \frac{56}{32} \times \frac{39}{30} = \frac{1}{1}$$

Using this formula, the set-up is as follows: The gear to be cut was held in place by using an extra Cincinnati milling machine arbor and bushings in place of a chuck, the arbor being mounted in the No. 3 dividing head *A*, as shown. A 56-tooth gear *B* was used on the worm shaft of the dividing head *A*, and a 32-tooth gear *C* on the worm shaft of the dividing head *D* of a No. 2 Cincinnati milling machine. Between these gears an idler was held in position by bolting the base of a vise to the milling machine table.

In getting the proper spacing, the crank of the head *D* was held stationary by bolting a *U*-strap to the side of the milling machine table. By using 30 spaces of a 39-hole circle, and turning the indexing plate *E* instead of the crank, the proper spacing was obtained.

A little study shows how the result was obtained by the two dividing heads. To get the 1/91 revolution indexing required for the cutting, the worm shaft of *A* must be turned 40/91 of a turn. The intermediate gearing and the head *D* enable this rotation to be accurately made. The gearing is such that 30/39 of a turn of the worm shaft or of the indexing plate of head *D* are required.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

November 15, 1923

Special or Standard Machine Equipment

THE aim of the production manager is always to secure a product of the proper quality at a minimum *net* price. It is this question of *net* however, which makes the problem much more difficult than it seems on the surface.

There are many instances where the net cost is way above the estimate because of failure to make suitable allowances for the delays which inevitably occur in using nearly all classes of machinery. Special machinery is built which shows a tremendous saving over the simple machines originally used and as long as the demand keeps them busy, the cost is pleasingly low. But when the machine which represents a $25,000 investment must stand idle half the time, the cost per piece goes up amazingly.

Furthermore, we all know from experience that the more highly specialized a machine the more apt it is to be out of commission, simply because there are more opportunities for parts to fail and mechanisms to get out of adjustment. And when a special machine, which represents eight or ten simple machines grouped into one, fails from the slightest cause, the whole eight or ten units are idle until the readjustment is made. The same delay frequently occurs when cutters become dull, which has a tendency to make the operator use a tool longer than he should for best results.

Highly specialized machines have their place in large manufacturing plants. They have made possible many little economies which total up to a large reduction in production costs. But in view of the large investment involved, the production managers of small or moderate sized plants will do well to consider the factors pointed out by Ralph E. Flanders in his recent paper on utilizing standard machines. This was reproduced in abstract on page 653, Vol. 59, of the *American Machinist*, and is well worth careful consideration.

We must bear in mind that, as mentioned in the beginning, it is the problem of *net* costs that makes it necessary to select both machines and methods with extreme care. And this must include a careful consideration of all the conditions which enter into the case.

Labor Turnover and the Use of Machinery

MANY PEOPLE have condemned the report of the so-called Coal Commission because of its failure to evolve a formula to end all coal strikes. The commission, of course, was not appointed with any such purpose in view. Its job was to find out the facts involved in the mining and distribution of coal and its voluminous reports certainly cover them pretty thoroughly.

One of the most interesting facts, from our point of view, is what might be called the stabilizing effect of machinery. In the section of the coal report devoted to labor conditions figures are given which show that the per cent of turn-over among machine miners is seventy-five. Of the pick miners, ninety-six per cent change jobs annually, while of the loaders, 109 per cent get tired of their jobs.

Mining machinery has met the same opposition from the workers as have other kinds of machinery when attempts were made to introduce them. That such opposition is foolish and contrary to the best interests of the men themselves has even been admitted by the president of the American Federation of Labor.

It has been common knowledge for many years that the introduction of machinery into an industry, while it may work temporary hardships, inevitably means more work for many more men in the long run. To the worker it spells better wages, to the manufacturer, bigger profits, to the consumer, cheaper goods. But here in the coal industry seems to be another factor, stabilization. Evidently the reduction in heavy labor and the improvement in pay tend to make the man more contented with his job.

Improvements in Railroad Shop Equipment

ONE HAS but to study the later equipment of some of our more progressive railroad shops to see a decided change for the better both in the machines themselves and in the selections which have been made. True, we occasionally find the entire appropriation expended on a wheel lathe or on back geared lathes for brass work which is not heavy enough to warrant their use. But other shops make similar mistakes at times and the trend is in the right direction.

Railway shop executives are taking a keen interest in newer and better methods of doing work and grinding is receiving more attention than ever before. There is also a tendency to eliminate unnecessary work and different plans are being tried to avoid the necessity of planing the babbitt in cross heads and to avoid other operations which are not necessary to the proper working of the locomotive.

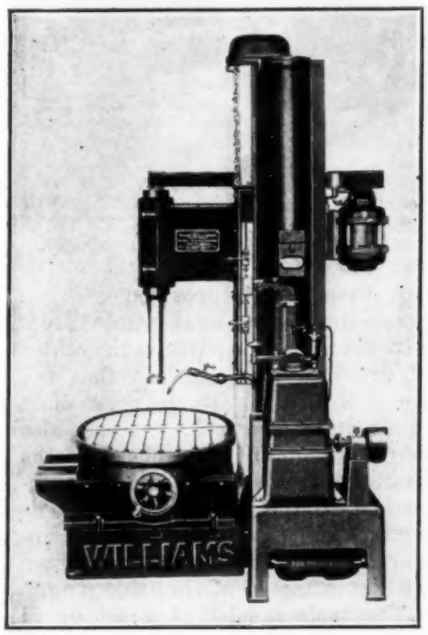
One thing which is needed is the opportunity for railway shop executives to visit manufacturing shops where work is done in different ways. There are plenty of shops doing work of a somewhat similar nature in which new ideas can frequently be obtained. Nearly every shop has some methods which can be successfully used by others, and it is by exchanging ideas and using those which are applicable, that we make real and rapid progress.

If railway shop executives are encouraged, even a little, by those higher in authority, they will put the railway shop on a more sound and efficient basis than ever before. The main encouragement needed is to give them the better shop equipment which they all want—and need. And it will help to pay dividends by reducing the time of the locomotive in the shop, for every day out of service counts heavily against the earning power of such a large investment unit. This is a factor which is not always considered.

Shop Equipment News

Williams Vertical Internal Grinder

The Williams vertical internal grinder, shown in the accompanying illustration, is, with the exception of the grinding head and the work table, very similar to the Williams vertical



WILLIAMS VERTICAL INTERNAL GRINDER

cylinder which was described on page 714, Vol. 59, of the *American Machinist*. The machine is now being marketed by the Hi-Way Service Co., Elkhart, Ind.

The grinding spindle and its driving motor are both mounted on the head, the motor driving the spindle through a belt at 7,000 r.p.m. The regular spindle is adapted to grind holes from 3½ to 20 in. in diam. The diameter of the spindle arbor is 3½ in., tapering to 3 in., and 15 in. in length. Arbors 18 or 24 in. long can also be furnished.

The work is mounted upon a revolving table, 24 in. in diam. The table has an in-and-out travel of 12 in. and is driven by a ¾-hp. 3-speed motor mounted at the left of the table. Starting, stopping and speed changes are controlled by a drum-type controller on the opposite side of the table.

The feed of the head is controlled in the same manner as the previously-described cylinder grinder, that is, by means of an Oilgear pump operating a hydraulic ram under the head. The range of feed is up to ⅝ in. per revolution of the work, and quick traverse to and from the work is also provided. A water pump is mounted on the stand with the oil pump and is driven by the same 1-hp. motor.

The floor space occupied by the machine is 49x42 in. and the height is 7 ft. 6 in. The weight of the machine, crated, is approximately 5,500 pounds.

Taft-Pierce Micrometer Plug Gage

The Taft-Pierce Mfg. Co., Woonsocket, R. I., has placed on the market an expanding plug gage designed to take the place of solid plugs and possessing the advantage of giving the user immediate information as to the exact amount of departure from standard diameter, parallelism or roundness of the holes to be gaged.

The gaging surface consists of four shoes bearing upon a conical plug at the center of the tool and held in place by dovetailed retaining blocks. The conical plug is susceptible to an endwise movement actuated by a micrometer screw, the thimble of which is graduated to read directly in ten-thousandths of an inch measured over the diameter represented by the outer surface of the shoes. The increments of measurement are thus the sum of two movements: the axial advance of the conical plug within the body of the tool by means of the micrometer screw, and the wedging action of the plug as the cone is drawn into the seat formed by the correspondingly inclined under surfaces of the shoes.

Adjustable limit stops operating in both directions are provided, and can be set and sealed to allow any desired amount of tolerance when using the tool as an inspection gage. The stop mechanism can be thrown out of action instantly when it is desired to determine the actual amount of error in a doubtful piece, and can be as quickly returned to position. The gage is easily taken down for the purpose of cleaning and readjusting by loosening two screws. The readjustment feature permits the gage to be reground, lapped and reset when the measuring surfaces have become worn from long usage.

All parts of the tool are hardened

TAFT-PIERCE MICROMETER PLUG GAGE

and ground and all working surfaces are carefully lapped. It is so designed as to balance easily in the hand and can be manipulated readily by the thumb and forefinger of the hand in which it is held, leaving the other hand free to handle the work.

It is made in 15 sizes ranging from ⅝ to 1½ in. Each gage has an individual range of slightly more than ⅛ in. in diameter so that it will overlap adjacent sizes.

Johansson Gage Blocks and Tools

The Ford Motor Co., Detroit, Mich., will continue to market the Johansson gage blocks and measuring tools. These instruments were formerly manufactured and sold in America by C. E. Johansson, Inc., Poughkeepsie, N. Y., which company was recently acquired by the Ford organization. The purchase also includes the sole American rights to the gages and the methods by which they are made. These gages are used as standards by many manufacturers and will still be available.

Beeman & Broughton High Speed Steel Furnace

The Beeman & Broughton Co., 458 Twenty-first St., Detroit, Mich., is now marketing an addition to its line of furnaces which consists of a gas-

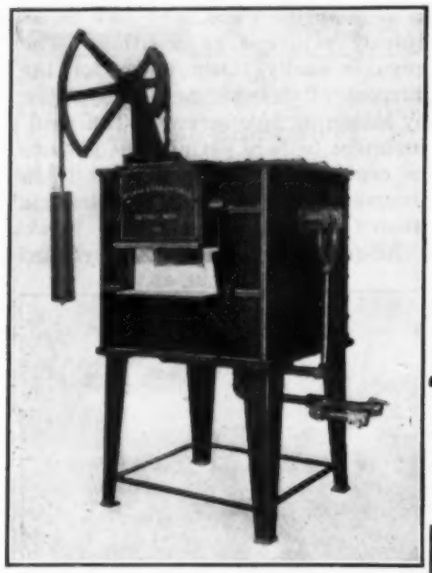


FIG. 1—BEEMAN & BROUGHTON HIGH SPEED STEEL FURNACE

fired furnace for heat-treating high speed steel. Fig. 1 shows an outside view of the furnace, the feature of which is the method used to apply the heat to the tools, claimed to impart exceptional cutting qualities and

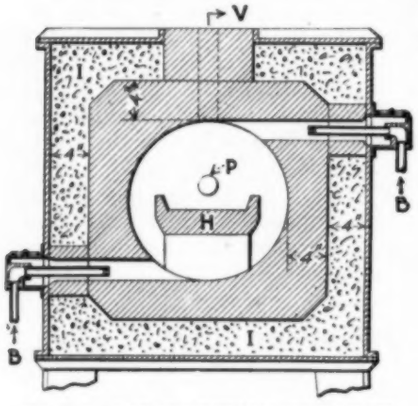


FIG. 2—CROSS-SECTION THROUGH BEEMAN & BROUGHTON FURNACE

leave the tool clean and free from flame erosion and warping.

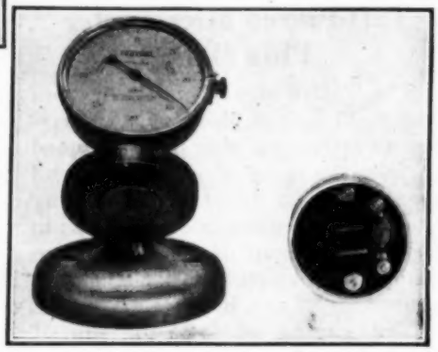
A cross-section of the furnace through the heating chamber is shown in Fig. 2 and it will be noted that the heating chamber is cylindrical. The flames from the burners *B* enter tangentially and rotate around the firebrick hearth *H* on which the tool is supported. The tool rests in the center of a swirling cylinder of flame which does not impinge on it, but heats it by radiation instead of by contact.

The opening for a pyrometer is at *P* and the vent openings are at *V*. The furnace is insulated by means of Sil-O-Cel and the firebrick lining is 4 in. thick. The outer casing and the legs are of cast iron.

Five standard sizes of the furnace are made, the largest of which has a 16x20-in. heating space on the hearth.

Federal Dial Gage for Radio Phones

The device shown in the accompanying illustration and now being marketed by the Federal Products Corp., Providence, R. I., is for the purpose of determining the distance between the ends of the electromagnets of a radio phone receiver and the edge of the shell upon which the diaphragm rests, thus showing at a glance the space, or air-gap, between



FEDERAL DIAL GAGE FOR RADIO PHONES

magnets and diaphragm. A phone with its diaphragm removed is also shown at the right of the gage.

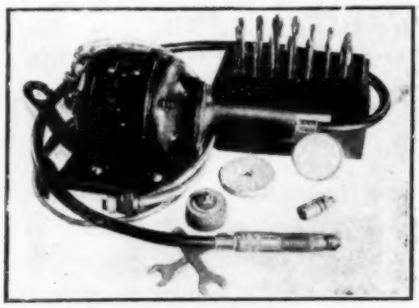
The device consists of a cast-iron base, made heavy enough to insure stability, and a standard Federal dial gage, to the measuring spindle of which is attached the smaller of the two disks of hardened and ground steel. The outer disk is stationary relative to the gage.

The gaging is done by placing the shell of the phone against the larger disk. The smaller one, bearing against the ends of the magnets, will then cause the pointer to show the distance between the two planes. Because of the large diameter of the disks as compared with the parts to be gaged the inspector cannot obtain a false reading, as no movement of the pointer will occur until the part is properly in contact with both disks.

Hergi Patternmaker's "Pal"

The Hergi Mfg. Co., 250 Fifth St., Bridgeport, Conn., has recently placed on the market a combination tool set especially designed for the use of patternmakers. The set consists of a ¼-hp. motor, a No. 5 Hergi flexible shaft, ball-bearing hand piece and tools.

The motor is mounted on a cast-



HERGI PATTERNMAKER'S "PAL"

iron base that is provided with an eye so that it may be suspended from a hook, and in this position the center of gravity is so disposed that the motor will hang with the rotor shaft in a vertical position. The base also permits the outfit to be placed on the bench, floor, or other location convenient to the work in hand. The motor can be supplied for any commercial current and voltage, fitted with an attachment cord and plug.

The tools consist of a set of 14 high-speed steel burs both file and mill cut; one ¾x3-in. grinding wheel; one 1x2-in. sanding drum; one No. 5 Hergi grinding spindle and necessary wrenches.

"Beltex Gripstick" Bar Belt Dressing

A bar belt dressing, called "Beltex Gripstick," is now being marketed by the Chicago Belting Co., 125 North Green St., Chicago, Ill. This dressing is furnished in 1-lb. sticks, 10½ in. long.

To apply the dressing the stick is held against the pulley side of the belt. This application is said to clean the belt of dirt and oil and make it soft and pliable. The dressing penetrates the belt and tends to eliminate the conditions which make slippage possible, that is, dryness of body and hard, glazed surface.

It is claimed that the ingredients of the dressing actually increase the life of the belt, and have no injurious effects.

News Section

A. S. M. E. Completes Plans for Annual Meeting

Many talks and discussions of special interest to the machine tool industry have been scheduled for the annual meeting of the American Society of Mechanical Engineers which will be held Dec. 3 to Dec. 6 in New York City. Plans for the meeting this year are on a more elaborate basis than heretofore, and members are looking forward to sessions filled with value.

Of especial interest to the machine tool makers will be the general session to be held Tuesday morning. H. A. S. Horwarth of the Kingsbury Machine Works, Philadelphia, Pa., will present a graphical study of journal lubrication and there will be other problems discussed.

On Wednesday the economic phases of coal shortage will be discussed by F. G. Tryon of the United States Geographical Survey, Washington, D. C., in the fuel session, while in the ordnance session, Capt. H. W. Churchill, executive assistant in the New York district ordnance office, will speak on "Some Production Problems in the War Department's Preparedness Plan."

Perhaps the greatest interest will be shown in the machine shop session to be held on Thursday morning when three speakers of unusual ability will be heard. D. P. Cook of the Boston Pressed Metal Co., Worcester, Mass., will speak on "Some Principles and Examples of Metal Development." W. W. Galbreath, president and John R. Winter, general superintendent of the Youngstown Pressed Steel Co., Warren, Ohio, will present their theories on the development of modern stamping practice outlining the history of pressed metal and showing how great its contribution has been to industry.

Other Features

There will also be a progress report on the present status and future problems of the art of cutting metals presented at this session.

In the afternoon at the management session, R. T. Kent, consulting management engineer of Montclair, N. J., W. L. Churchill, of the Industrial Engineering Service, of New York City, and E. H. McKitterick of Lockwood, Green & Co., Boston, Mass., will present a symposium on the relation of mechanical engineering to management in the metal working, woodworking and textile industries.

Officers of the society are looking forward to the largest attendance in the history of the A.S.M.E.

Roads Will Continue Expenditures

The railroads will continue their intensive program of development next year, it was announced recently following a meeting of the American Railway Association in New York, attended by executives of ninety-four roads whose mileage totals 219,077 miles, or 95 per cent of that of Class 1 lines.

Statistics were made public which show that record-breaking expenditures for equipment and supplies were made in 1923. The total reached $1,059,440,000. In addition, there will be carried over into 1924 appropriations made this year for capital expenditures amounting to $243,804,000, or a grand total of $1,732,516,836 expended or authorized for capital improvements during 1922 and 1923.

In addition to the above, Class 1 railroads will in 1923 spend for fuel and supplies in currernt operation approximately $1,800,000,000.

Capital expenditures this year for increasing facilities, plus the expenditures for 1923 for fuel and materials and supplies used in current operation and maintenance, totaled $3,103,244,000. This did not include any direct expenditures by the railroads for labor, but went to the country's industries and represented, according to the association, one of the major causes contributing to the expansion of business and to the employment of industrial labor, which, in turn, was a primary factor in the increase in domestic demand for both products of industry and of the farm.

Many Machine Tools At Textile Show

The International Textile Exhibition and National Power Show held in Mechanics Hall, Boston, during the week of Oct. 29-Nov. 3, besides being an interesting display of the endless variety of textile products and the machinery contributing immediately thereto, serves to emphasize the inter-relation existing between this great industry and many others that, while of lesser magnitude, may justifiably be considered of equal importance.

Since the day when power was first applied to the preparation of materials and to the weaving them into fabrics, the growth of the industry has been dependent upon machinery, and to no other line of activity is due more credit for its continued expansion than to the designing and building of machine tools.

As an exhibition of the marvellously complex and intricate machinery involved in the production of textile fabrics the show was of surpassing interest not only to everyone directly associated with the industry itself, but to all whose minds are trained to think and reason along mechanical lines. To the observer whose business it is to design, construct or handle machine tools it is at once a revelation of what has already been accomplished and an incentive to further effort.

Evidence of the growing interest of machine tool builders was displayed by the numbers of such tools on the floor; tools that can have no possible connection with the production of textiles except that they were themselves directly concerned in the construction of textile producing machinery. The field for special tools and the special adaptation of standard tools was but the second largest in the country—perhaps in the world, and well worthy to be considered by our foremost designers and engineers.

Steam Still Important

Though the steam engine as a generator of power has been relegated to the background by electric motors that derive their energy from far distant sources, steam is a very important factor in the production of textiles; and the display of steam handling, regulating and distributing devices was very complete. Though many of the larger machines are driven by independent motors mounted upon or within the frame, power transmission devices were even more than ever in evidence. The silent chain has taken its place as a transmitter of power as quietly and unobtrusively as it does its work.

Taken as a whole, the show was quite as much an exposition of the part played in the industry by the machines that produce machinery as it was of the machinery that produces only textiles. The importance of the machine tool is being more and more recognized in the cloth making industries and improvement is perhaps more noticeable in this line than in many others.

Auto Output Gains in October

Automobile production for October was 360,924 passenger cars and motor trucks, according to factory shipment reports submitted at the Directors' meeting of the National Automobile Chamber of Commerce. It represented an increase of 11 per cent over the September output and makes a total production for the factories in the United States of 3,388,785 cars for the ten months since Jan. 1, 1923. The sales market for cars was reported better than September in most of the larger cities, such as New York, Cleveland, Chicago, Pittsburgh, St. Louis and Seattle. The demand for the next two months is expected to be better than for the same period a year ago.

Five cities in the country showed decreased accident records for October as compared with that month a year ago. They are Boston, Chicago, St. Louis, Seattle and Fargo.

Industrials and Railroads Buying in the Chicago District

There has been an increase in industrial buying in the Chicago district during the first week of November. Industrials have purchased punches, bull dozers, rolls and shears. As usual some dealers report an improvement in business and others state that there has been no change. As a whole there appears to have been some increase. The Indiana, Harbor Belt R.R. is making inquiry for a dozen machine tools including lathes, drills and punches. The Illinois Central R.R. has purchased a couple of lathes, and an upright motor-driven drill press. The Chicago, Burlington & Quincy R.R. has ordered 6 32-in. shapers from Manning, Maxwell & Moore and is reported to have purchased the lathes which were included in its recent inquiry. The Chicago, Rock Island & Pacific R.R. has not made purchases on the list of light machine tools which it made inquiry on several weeks ago. The New York Central is inquiring for machine tools for Elkhart, Ind. and Collinwood, Ohio. Several auctions of used machine tools have been held during the past week. The Northern Pacific Ry. has purchased a 200-ton locomotive crane from the Whiting Corp. The New York, New Haven & Hartford R.R. has ordered a small hand crane from the Whiting Corp. The New York Central has entered the market for seven 18-in. lathes, two punching and shearing machines, one 2,500-lb. steam hammer, one radial drill, and one 40-in. band saw.

Producers of steel are in a comfortable position so far as November is concerned, but December is still in doubt in some lines. There has been an increase in buying during the last few weeks, but the sales are not sufficient to insure the present rate of activity for any length of time. Much depends upon railroad buying, according to members of the trade, and unless the carriers go through with the expected buying program a curtailment of operations is certain. So far the railroads have indicated they would enter the market soon but no sizable orders have been placed.

Cleveland Expects Busy Winter

Actual orders so far are lacking in the Cleveland district, but there are inquiries to furnish encouragement. Of particular interest at the moment is an inquiry emanating from Japan, or its representatives in this country, for some 400 pieces of varied equipment. The large number of inquiries from railroad sources is likewise welcomed.

In keeping with this also must be reckoned the automotive industry, that part of it located in Cleveland as well as those interests located elsewhere, which already appears to be anticipating its 1924 requirements for additional equipment. Changes in motor car construction will account for this equipment interests.

Sales Before New Year

This inquiry movement, however, must be tempered for the machinery trade itself for the present, however, since such inquiries are not considered official until they actually come out of the purchasing departments. Yet the larger machine tool factors are confident that this business, a fair portion of it at any rate, will be coming forward before Jan. 1.

That this belief is well founded, may be proved by the fact that the Bourne-Fuller Co., one of the larger independent steel interests, is receiving orders for considerable quantities of semi-finished steel products from railroad interests.

From Youngstown comes the report that car manufacturers likewise are receiving goodly inquiries for rolling stock. The Standard Tank Car Co., has closed a substantial order, and is shipping cars daily to one rail interest, still heavier shipments to a large automotive factor, and making several smaller shipments to oil concerns.

In the matter of locomotives, orders are coming forward more slowly, in the opinion of officials of the Lima Locomotive Works Co., but inquiries have been received, and are expected to be backed by bookings, based upon the road and car work that has already been let. Though it may be waiting upon this new business, there is sufficient business on hand at the Lima to keep it running to capacity to March 1.

Probability that expansion of the Diesel engine production here will be seen at an early date, is indicated in the move by a committee of the Winton Co. to interest stockholders in that company in the purchase of the engine division of the concern. The committee undertaking this work included Alexander Winton, Thomas Henderson and George H. Brown. Until recently it was expected that the engine division would be taken over by other interests. Of interest to industry generally and Winton stockholders particularly is the committee's statement that it believes the Diesel engine outlook today is what the automobile business itself was a decade and a half ago. The committee will await the stockholders' decision for a few days before presenting their proposition elsewhere.

Indiana Business Slows Up

However optimistic the leading men in the industry may be in Indiana, the fact remains that users of machine tools and machinery have become exceedingly cautious in their orders. This does not apply to all lines, but for the most part the trade is finding sales a little more difficult. The furniture trade which has been a big buyer of woodworking tools and special machinery has curtailed expansion. This does not mean a cessation of production for most of the plants are working to capacity, but executives say there is not the same activity in the market there was two months ago. This leads them to believe next month will see plants pretty well caught up with their orders. Such plants as are at Shelbyville, Ind., just South of Indianapolis are maintaining their production schedules, but nearly all unite in admitting the situation is not as promising as it was.

Another slump has come from the automobile industry. Not only is this industry affected, but the accessory plants as well. Business with these factories was better this Fall than it has been for years and this was reflected on the tooling demands. During the last two weeks, however, plants in this section have slowed up their production and the tool industry has suffered thereby. The fact that the Haynes plant at Kokomo, Ind., was sued for receiver did not serve to put any further courage in the hearts of the local trade. Officials of the Haynes plant say as soon as they refinance, all debts will be paid, but this plant being one of the oldest in the country, the action came as a complete surprise to the local trade.

Demand from the brick industry in the western part of the state has been curtailed somewhat. Most of these plants are working better than had been expected this Fall, but they have curtailed machinery purchases. Some machinery is being sold in the coal fields, but the demand is not what it was last year. Weather conditions that have made logging operations possible until late, has helped the saw business, according to officials of the E. C. Atkins & Co. All machinery connected with the lumber industry, they say, is moving actively.

Slight Improvement in the South

Regarded as a whole, there appears to have been some slight improvement in machine tool sales in the Southern territory during the first several days of November, as compared with the same period in October, though there is still room for a great deal of improvement. A falling off in the sales to the smaller machine shops, which have been the principal buyers for some months, has been recently noted, and a slight increase in the sales to larger industries, principally in the textile and lumber fields.

As was the case two weeks ago, however, reports of the distributors in the Atlanta territory show a tendency to be "spotty," and it is difficult, therefore, to present any figures that might show the tendency of the business the past two weeks. It seems certain, however, that the month of October brought about a decline in total sales as compared with September, though proved fairly satisfactory as compared with the same month a year ago.

For the same reason, it is difficult to express definitely what the future portends, for the distributors seem disinclined to make any definite predictions, due to the fact that whereas the outlook seemed very bright some two months ago, sales have not been up to the mark that the trade had predicted it would be.

Yet, industrially the South has continued to show further improvement

during the latter half of October, and with the 1923 cotton crop now quoted at the Southern spot markets at nearly 32 cents per pound, machine tool business certainly should experience a period of increased activity. On this score virtually all of the distributors seem in agreement, but do not care to have themselves quoted as making the statement definitely.

But a general survey of the outlook for the next eight or ten months presents a very favorable picture, and the trade should enter 1924 with business on a much more satisfactory basis than was the case at the beginning of 1923, in spite of the fact that machine tool sales during the early part of this year were exceptionally good.

New England Gets Auto Orders

The Summer quietness in the automobile industry, reflected in contributing industries, is well over, in the opinion of sales managers and works managers of plants of the allied industries in New England. "We have orders for 90 to 120 days ahead from our regular customers," said the sales manager of one of these companies, and basing his conclusion that the usual quiet season is over he cites the fact that these big buyers are now ordering more heavily. The inquiries are also more firm and indicate a better interest. Substantially the same conclusions were drawn by others.

Opinion was expressed by four factory representatives that the labor supply now is better than it has been for some time. No difficulty is experienced in obtaining the mechanics necessary. Few changes are now being made by workmen. There has been no change in wage schedules of the workmen in the factories whose representatives were interviewed, and there was a unanimity of belief that there would be none.

Immediately following the Japanese earthquake a number of manufacturers in the Hartford district received orders for export and a conclusion drawn was that they were the direct result of the disaster. An analysis of the orders since has led to a change in the inference drawn and that is that the orders were purely for stock and that orders as a direct result of the earthquake have not yet been received and consequently this business is still held in anticipation.

Philadelphia Sales Are Steady

Leading industrial establishments in Philadelphia have sufficient business in hand and in prospect to keep their plants in operation for four or five months. This was hailed as a hopeful outlook for this season of the year, when most businesses apply the economic rule of curtailment to make a satisfactory end-of-the-year showing to their bankers.

The plants from which the hopeful signs come are the Electric Storage Battery Co., the Baldwin Locomotive Works, and J. G. Brill & Co., car builders. The business situation generally presents a strengthening outlook.

Detroit Auto Output Continues to Aid Machine Tool Business

As production figures from the automobile plants of Detroit and vicinity continue to set marks that are considerably in excess of anything ever experienced at this season in previous years, Detroit business in general, especially in the metal working fields, is finding itself in an enviable position as contrasted with other large centers.

Machine tool manufacturers report a steadiness in the market that augurs well for the industry in this section. A decline in the industry is expected during the inventory season that is approaching in most of the large firms of the city, but the slump will be only temporary, it is believed by those in a position to know.

In support of this belief, the recent business forecast of the Merchants National Bank of Detroit is given attention. In part the forecast said:

"A development of great significance during the past month has been the changing perspective of business men. Swift and striking changes in the economic picture since 1914 have led most business men to think of good times only in terms of racing prices and great waves of profits. They are now adjusting themselves to the view that the coming months are likely to bring neither a boom nor a deep depression. Rather they expect a fair volume of trade at reasonable prices, with the competition among sellers and not among buyers.

"The industrial skyline is pronouncedly irregular. The most favorable factors include some improvement in the steel trade, better agricultural condition, phenomenal freight traffic, sound credit conditions, increasing exports, a good rate of building activity and continued large employment with good purchasing power."

Building contractors say they have sufficient work to keep them going comfortably for two or three months, and considering the industrial and other projects which are known to be going ahead, it is the consensus of opinion that there will be no seasonal slump this Winter. Contracts let for the past week were of good volume.

Railroads report an increase of from 20 to 41 per cent in outbound shipments from Detroit and received freight shipments averaging 21-25 per cent more than in October.

The machine tool industry continued to look with hope for a satisfactory situation after the year's end.

The William Cramp and Sons Ship & Engine Building Co. has been awarded a contract for building and installing three 9,850-hp. turbines for the Kentucky Hydro-Electric Co. The Cramp company also is installing in the Niagara Falls Power Co.'s plant a 70,000-hp. turbine. Another contract is for a turbine for the St. Croix Paper Co.'s plant in Maine. The Philadelphia office also announced the San Francisco plant of the Cramp company is building three 33,000-hp. turbines for the Pacific Gas & Electric Co.

The volume of employment in manufacturing establishments throughout Pennsylvania, New Jersey and Delaware is greater now than a month ago, it is found by the Federal Reserve Bank. Notable gains were made among the metal manufacturing industries. The third quarter of 1923 showed a large sale of automobiles, and inquiries point to a satisfactory situation.

The action of railway executives at their recent meeting in New York in announcing large expenditures will be carried over into 1924 was regarded as a most hopeful indication. The close of the year has, as usual, found the railroads curtailing purchases to actual necessities.

The general business situation is satisfactory, with retail sales far in advance of this period a year ago.

Ford Trucks Shipped to Japan

First shipments of 1,000 Ford one-ton truck chassis for the city of Tokio, Japan, have been made by the Ford Motor Co. This is taken as an evidence that Ford trucks will play an important part in the reconstruction of the devastated sections of Japan and in furnishing transportation for the thousands of inhabitants in the affected regions.

New York Maintains Steady Trade

The steady trend of business in the machine tool line in New York City is one of the encouraging features to be noted this week. Dealers were unanimous in stating that, while the volume could be improved considerably, business was good and most important to them it is steady with all indications being that it will remain so for the next few months or well into the Spring of next year.

Railroad buying rumored for the last part of November had begun to materialize earlier than expected and before the tenth of the month sales were reported. Many lists are out at this time from the roads. The New York Central, the Delaware, Lackawanna & Western the Lehigh Valley, the Baltimore & Ohio, the Rock Island, and the Central Railroad of Georgia all have inquired for tools within the past two weeks and some of them have also purchased in the New York district.

Industrial buying seemed to be improved recently and reports from New York City and some parts of New York State would indicate that manufacturers are renewing machine tools and machinery for the Winter and for the expected heavy business of next Spring. Good sized sales were reported from Elmira, Syracuse, Schenectady and Troy.

Makers of parts for automobiles have been in the market during the past week for several different tools. Immediate delivery was asked for in most cases and dealers are of the opinion that the future buying of these concerns will be on a larger scale than during the past ten months of the year.

Used tools were in fair demand during the week. Small shops bought some lathes and presses and dealers state that this part of the industry expects a good portion of the business.

Railroads Show Good Gains

One hundred and ninety-four Class 1 railroads, representing a total mileage of 235,812 miles, earned 4.46 per cent on their tentative valuation during September, compared with the 5.75 per cent fixed as a fair return by the Interstate Commerce Commission. The tentative valuation set up by the commission includes additions and betterments up to Jan. 1, 1923, and is for rate-making purposes.

The same carriers in September last year earned a net operating income of $58,677,600, which was at the annual rate of 2.90 per cent. In August, 1923, their net operating income was $98,343,200, or at the rate of 4.94 per cent. September net operating income totaled $92,238,400.

Further tabulations by the Bureau of Railway Economics, made public by the American Railway Association, show that in the Eastern district the rate earned in September was 3.93 per cent; in the Southern district, 5.20 per cent, and in the Western district, 4.80 per cent.

In comparing the earnings of the roads for September, account must be taken of the shopmen's strike which continued for that month and two preceding months in 1922, at which time the coal miners' strike was also in progress.

Some Roads Lose

Twenty-two Class 1 roads operated at a loss in September, according to reports filed with the Interstate Commerce Commission. Eleven of these roads were in the Eastern district, two in the Southern and nine in the Western. In August, sixteen of these roads reported operating deficits.

Operating revenues of the Class 1 roads in September totaled $545,502,700, an increase of $44,620,000, or 9 per cent over the same month last year, while operating expenses amounted to $415,983,000, an increase of $7,070,600, or about 2 per cent, over September last year.

For the first nine months this year net operating income of the 194 railroads represented an annual rate of return of 5.27 per cent on their tentative valuation, amounting to $718,949,000, compared with $529,470, or about 3.96 per cent, for the same period of 1922.

Class 1 carriers in the Eastern district, according to complete reports, had a net operating income in September of $37,380,000, which was at the annual rate of 3.93 per cent on their tentative valuation.

Southern Plants Are Well Employed

A questionnaire to determine accurately on just what basis the foundries and machine shops of the South are operating was sent out during the latter part of October to members of the Southern Metal Trades Association and replies received to date indicate that production is on a fairly satisfactory basis. The questions asked included annual and monthly capacity of each foundry and each machine shop operated by members, total production in October, percentage of capacity and number of employees.

In the foundry trades some reports were low, but as a whole production seemed to be around 75 per cent of total capacity, with two or three of the larger plants operating at 100 per cent. In the machine shops reports showed operations on about the same basis, and especially satisfactory as compared with the same month last year.

All the machine shops were operating, however, and though one or two of the smaller plants were only at about 25 to 30 per cent of capacity, as a whole conditions were satisfactory, though somewhat less so than during the early part of the year. The outlook, according to the replies received, seems to be very good, with owners of both foundries and machine shops looking for marked activity during 1924.

Buell with Diamond Co. Thirty-Five Years

On Nov. 2, William C. Buell, vice-president and secretary of the Diamond Machine Co., Providence, R. I., celebrated the thirty-fifth anniversary of his start with the company. Mr. Buell's long experience on the road has built up for him an unusually wide acquaintance and his loyalty and consideration of others have made for him almost as many warm friends. After so many years of hard work for his company he is beginning to devote a little more time to his family and to his farm where he grows wonderful dahlias and gladioli.

Business Good in West Says Egan

Clifford P. Egan, president of the J. A. Fay & Egan Co., Cincinnati, Ohio, on his return from an extensive Western tour is very optimistic in the outlook for future business and a continuance of prosperity.

Mr. Egan said: "With the Japanese government removing the duty on piece lumber, many of the tidewater mills have withdrawn from the domestic market while the Japanese market looks so big."

Inquiries are received by his company in good volume and indications point to a moderate revival in building activities as the sash and door manufacturers have a good volume of orders on their books and are looking to increase their production with more modern equipment.

Gear Grinding Machine Co. Wins Suit

The award of approximately $54,000 to the Gear Grinding Machine Co., Detroit, from the Studebaker Corp., has been confirmed by the Federal Court in that district. The Studebaker Corp. must account to the Gear Grinding Machine Co. for 322,483 shafts at fifteen cents each and interest since manufacture.

The case was brought by the gear grinding machine company who claimed an infringement of patents and the decision in its favor was sustained by the United States Court of Appeals and referred back to the Federal district court for an accounting.

Cincinnati Holds Recent Gains

Production of machine tools in Cincinnati is holding up to a fair standard at the present time with some improvement evident over the conditions that prevailed several weeks ago. While it is not expected that there will be any startling developments in business activities during the rest of the year, most of the firms that experienced a decrease in the volume of their orders recently have recovered sufficiently to report that their production has again become more nearly normal. There has been somewhat of a falling off in the buying being done by automobile manufacturers and indications point to a continuation of this condition throughout the remainder of 1923. It will be rather unusual if orders from the automotive industry show much of an increase until after the first of the year.

The larger manufacturers in this district state that business during the month of October and through the early days of November has been fairly good. The main thing that is brought home to the manufacturers is that it is necessary to get out and dig for every bit of business that comes in. Those firms that are showing aggressive activity in their sales department and are working hard every minute are producing results which, although they may not be above the average, are good enough to insure a fair volume of factory production.

An encouraging feature of the present situation is the fact that practically every plant in the city is considerably ahead of its 1922 production figures. This year has shown a decided improvement over last, and even the slump that hit the industry in October did not change the records which credit the industry in Cincinnati with a decided improvement over last year.

Demand for Lathes

Lathes are selling fairly well, and the present standard of business in this line is expected to continue the rest of the year. It is understood that the Ford Motor Car Co. has some inquiries out. The Pennsylvania Railroad Co. is expected to place some orders soon, according to reliable reports. There has been spasmodic buying of upright and radial drills and the market in this line has been rather dull with little hope for a change to better conditions for several months. Conveying machinery houses state that their shops are full of orders at present and, judging by the orders now on hand and the number of inquiries being received daily, good business will continue until after the first of the year. One pleasing feature of the conveying machinery situation is that orders are not confined to any one section of the country, but are being placed generally.

Woodworking machinery concerns are enjoying a very good season. One of the largest plants is running at capacity and is working shifts three nights a week in order to get out machinery at the specified time for delivery. The outlook in this field is particularly good. The production of Cincinnati foundries is not as large as it was a month ago. Orders have not been so plentiful and, consequently, production has been curtailed to some extent.

Business Items

The Crofoot Gear Works, formerly of Cambridge, Mass., but now located in Chicago, Ill., has been purchased by Bradford Foote who has sold his interest in the Foote Brothers Gear & Machine Co., Chicago.

The Pioneer High Speed Machine Knife & Tool Co., Cleveland, Ohio, has been formed. A. W. Erickson, formerly superintendent of the Wapakoneta Machine Co., Wapakoneta, Ohio, is president.

The plant and the shops of the Quitman Machine Co., Quitman, Ga., destroyed this month by fire, are to be re-established at an early date, it has been announced by officials of the company at Quitman, Ga. Three other buildings were destroyed in the fire, loss exceeding $100,000, but largely covered by insurance.

The general offices of Edgar T. Ward's Sons Co. have been moved to 400 Frelinghuysen Ave., Newark, N. J., from Philadelphia, Pa.

Piecemeal sale of equipment and supplies of the Stroh Casting Co., Detroit, for approximately $35,000, was confirmed recently by Judge Ormond F. Hunt in the Wayne County Circuit Court.

The Fisher Body Corp. will construct a plant costing approximately $650,000, in Tarrytown, N. Y., officials of the corporation have announced. The plant will be erected on the Chevrolet Motor Co. property.

Elgin Motors, Inc., is the new name of the Elgin Motor Car Corp., formerly of Argo, Ill., now located at 323 West Fifteenth St., Indianapolis, Ind.

The Lincoln Products Corp., Newark, N. J., has taken over the sales rights for northern New Jersey for the Crescent electric industrial trucks and tractors. The trucks and tractors are made by the Crescent Truck Co., Lebanon, Pa.

The *Far Eastern Review*, a monthly American engineering paper published at Shanghai, China, has opened a branch office at 50 Church St., New York City.

The Sawbrook Steel Castings Co. has been organized at Cincinnati, Ohio, for the manufacture of steel castings from electric steel material. A new plant will be erected and the capitalization at the present time is put at $200,000. The officers are: E. S. Sawtelle, president; A. E. Anderson, vice-president, and Edward L. Brooks, secretary-treasurer.

The Schubert-Christy Construction & Machinery Co., Railway Exchange Bldg., St. Louis, Mo., has been organized by Frank H. Schubert, district manager of the Wheeler Condenser & Engineering Co., and Wm. G. Christy, formerly with the St. Louis Boat & Engineering Co. The company will represent manufacturers of power plant equipment and will render general design and construction engineering service.

William F. Wendt Dies in Buffalo

William F. Wendt, aged 65 years, died recently at his home in Buffalo. Mr. Wendt was the founder and the former president of the Buffalo Forge Co. He was prominent in many lines of endeavor having been president of the

George L. Squier Manufacturing Co., the Buffalo Steam Pump Co., the W. F. Wendt Publishing Co. and other companies. He retired in 1916 as president of the Buffalo Forge Co. and two years ago as president of the W. F. Wendt Publishing Co.

Mr. Wendt was prominently connected with Republican politics in Buffalo although he never held office himself.

His brother, Henry Wendt, is the present president of the Buffalo Forge Co.

Obituary

CLARENCE C. SMITH, a design engineer of the Western Electric Co., New York City, was drowned recently near New York City.

WILLIAM M. THOMAS, ballistic engineer at the Union Metallic Cartridge Co., Bridgeport, Conn., for fifty-four years, died of pneumonia Nov. 7, at his home in Stratford, Conn. He was ill nine days. Mr. Thomas was 75 years of age. He leaves his wife, two sons and two daughters.

EDWIN R. BALL, for the past twenty years general manager of mining operations for the Tennessee Coal, Iron & Railroad Co., and recognized as one of the leading iron mining experts in the South, died recently at his home in Birmingham, Ala. Mr. Ball was 65 years of age.

AMOS P. MACK, president of Mack & Co., Rochester, N. Y., died suddenly at his home in that city. Mr. Mack was well known among western New York machinery men.

Personals

JAMES J. DALE has resigned as vice-president and director of the Consolidated Machine Tool Corp. of America, Rochester, N. Y.

E. P. BLANCHARD, advertising and sales manager of the Bullard Machine Tool Co., will give the salesmanship course at the Union Y. M. C. A. educational classes in Bridgeport, Conn., during the Winter.

EDWARD M. WOODWARD, JR., has been elected president and treasurer of the Woodward & Powell Planer Co., Worcester, Mass., succeeding his father, the late Edward Woodward.

L. L. THWING, who for the past two years has been an appraisal engineer with the Income Tax Unit, has resigned and will open an office in Cleveland as a consultant in amortization cases.

W. T. COLLIER, for the past thirty years connected with the Standard Machine Screw Co., Elyria, Ohio, has entered upon his duties as general manager and vice-president of the Hartford Machine Screw Co. in Hartford, Conn. He was treasurer of the Western plant. Mr. Collier succeeds FREDERICK S. THOMPSON, who plans to take a year's rest. Mr. Thompson came to Hartford three years ago and for twelve years prior was with the Niles-Bement-Pond Co. at the Plainfield, N. J., plant.

JOHN W. ROBINSON has been named secretary and vice-president of the Woodward & Powell Planer Co., Worcester, Mass.

COL. A. W. ERDMAN, manager of the small tools department at the Pratt & Whitney Co., Hartford, Conn., has been granted a six months' leave of absence on account of ill health and leaves shortly for a complete rest. C. M. POND is temporarily filling the position.

GEORGE C. STEIL, who has been the factory representative for the Whitney Manufacturing Co. in eastern Massachusetts and Rhode Island, has been made a distributor for that company and has his office at No. 740 Commonwealth Avenue, Boston.

W. H. HENDERSON, of New Bern, N. C., and O. W. LANE and others, have organized and incorporated there the New Bern Machine Shop & Foundry Co., according to a recent announcement.

COL. W. G. SHEEHAN, president of the Society of Industrial Engineers, was in Washington last week conferring with War Department officials in connection with plans for industrial mobilization.

A. S. BISGOOD, for many years with the Purinton & Smith Co., Hartford, Conn., and also with Machinery Dealers, Inc., New Haven, Conn., has gone into business for himself with offices at 286 Courtland Ave., Bridgeport, Conn. Mr. Bisgood will handle both new and used machines in the New England and Eastern territory.

The Industrial Review

Bright future in the machine tool line if railroads and auto builders continue expending program—Electrical field busy—The high cost of building

ACCORDING to the best authorities in the machine tool industry, it is more encouraging to look toward the bright future of tomorrow than to consider the situation of today. The monthly totals for October in all parts of the country showed that business was better than it was in September. But sales during the last week of that month and the first week in November were plainly disappointing and by some of the manufacturers characterized as worse than that.

Against this dark blue background, loom up promises and hopes for the very near future that are, to say the least, encouraging. Inquiries are plentiful, railroads are rumored customers for the last part of the month, Henry Ford has made a brave announcement of daily production of 10,000 cars by Spring, the United States Steel Corp. has increased its quarterly dividend and declared an extra dividend, general building conditions are better now than for a long time past and programs of expansions are heard of more often than at any time since last April. But actual buying, nevertheless, is quiet and promises after all are poor substitutes for performances.

Automobile production generally is in fine shape, although some of the builders are not as busy as they would like to be. Closed body models are being sought in all quarters and factories making parts for closed cars are working at a good rate.

Railroad buying during the past two weeks has been for necissities in the form of single tools with the exception of a few Eastern roads that have made good on lists that have been out. Locomotive shops and car building plants have also bought freely during the past fortnight.

Textile manufacturers in the New England states have bought nothing for some time and nothing is expected from this quarter until Spring. Southern textile manufacturers, however, are in the market for machines from time to time.

Electrical Business

Appliance selling holds the center of the field in the electrical trade this week. In all parts of the country demand is strengthening, and manufacturers are reporting a heavy call for the full line of electrical comfort and labor-saving appliances that are suitable for Christmas gifts. Jobbers are devoting a large share of their attention to this holiday trade. The prevalent feeling seems to be that sales this year are going to set a new record for the electrical industry.

The general tone of business in the East is better this week. Boston, Philadelphia and Atlanta experienced a stronger general demand, though in the New York district porcelain, conduit, wire and wiring devices generally were slack and the market was characterized as "spotty."

In the Middle West general business was steadier although sales in either the Chicago or the St. Louis area were not large. There was a slight reduction in the price of wire and pole-line hardware reported in St. Louis. Conduit and wire were selling better in Chicago than the week before. Business on the Pacific Coast continues in good volume with prices steady. Orders from Japan to the lumber and other industries continue to influence considerable buying of electrical material. Throughout the country sales of radio material are steadily increasing.

Electric Railways Prosper

A substantial argument indicating the return of prosperity to the electric railways can be found in the United States Census figures for 1922. In that year more than 12½ billion pay passengers were carried by electric railways in the United States. This figure represents an increase of 12 per cent over the previous census of 1917. Further, this is an increase of 2.5 per cent per year while population has increased less than 1 per cent. The operating revenues of the electric railways have increased 47 per cent over 1917 and now are close to a billion dollars annually. In addition, it is estimated that $250,000,000 in new capital is needed for improvements and betterments for the current year. These facts establish the electric railways as a necessary business with increasing traffic, increasing revenues and increasing facilities. Emphasis was laid on these points recently by a representative of the electric railway industry in presenting a brief review of the status of the railway before the Investment Bankers' Association.

In the machine tool industry prospects are bright if the present is dull and indications are that the next six months will bring forth a good volume of sales; the electrical manufacturers are busy with the Christmas business that started earlier than usual; street car business shows big improvements as compared with the past; bus makers report excellent returns for the year; mining is more than holding its own in all fields of activity; and the building figures show substantial increases in all parts of the country.

Another favorable factor has been the introduction of means of more economical operation. This included the one-man car of which 10,000 are now in operation as compared with fewer than 1,000 in 1917. The use of the automatic and remotely controlled sub-station equipment as a factor in reducing power costs and the use of power saving devices are resulting in material reduction in the total cost of power. In the maintenance and repair departments the use of electric and metal composition welding processes has effected great savings.

Building Many Buses

Manufacturers of buses report that the present volume of sales is holding close to the level of the first six months of 1923. The White Motor Co. states that the business done by it during July was the best in the history of the firm for the same month. August sales showed some slackening throughout the manufacturing field, as is normally the case at this season of the year. Outlook for the final quarter of the year indicates that business will continue at a rate close to that of the first six months.

Mine Production Good

Production in both coal mines and others continues at a satisfactory rate for this time of the year. Improvements in the Western copper and iron mines have been going along with more activity than in other years and the indications are that equipment buying will continue as long as production keeps up.

Coal mining during the past fortnight has stayed at a steady level which is unusual considering that the sales of bituminous have been slight and anthracite needs are mostly taken care of or anticipated.

High Cost of Building

A fact that may not be generally recognized but deserves serious consideraton is that, although the value of contracts awarded in the first ten months of this year is $330,000,000 greater than in the same period of 1922, the actual physical volume of construction is only 1½ per cent above last year. *Engineering News-Record's* Volume Index Number for the ten months of 1923 is 132 against 130 for the same period of 1922 and also for the whole of 1922. This is due entirely to high cost. The Cost Index is 214 for the ten months of 1923 and 173 for 1922.

The sharp rise in industrial building in October is attributable to the $20,000,000 power plant at Kearney, N. J., for the Public Service Corp.

Carnegie Corp. Donates to Technical Study

An appropriation of $108,000 for the study of engineering education was made on Oct. 31 by the Carnegie Corp. of New York, the study to be conducted by a director responsible to a committee of the Society for the Promotion of Engineering Education. As the *American Machinist* goes to press news comes from the committee that W. E. Wickenden, assistant vice-president of the American Telephone & Telegraph Co., has accepted appointment as director.

The resolution adopted by the Carnegie Corp. sets aside for the purpose $24,000 during the present fiscal year and $12,000 during the fiscal year 1924, with the understanding that if, in the judgment of the executive committee, substantial progress shall have been made in this study by Jan. 1, 1925, the balance of the $108,000 will be made available to the society as follows: $24,000 additional during the fiscal year 1924, $48,000 during the fiscal year 1925.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THIS is written from Houston after a week spent in traveling over the state of Texas.

The optimism manifested here is not surprising for cotton has advanced nearly four cents a pound within the last ten days and the state crop, estimated at 4,300,000 bales, will sell for at least six hundred million dollars even after allowing for the deterioration in quality due to the heavy rainfall.

Adding to cotton the other crops grown here the agricultural production of Texas this year will probably be worth about a billion dollars. If the values of the cattle, hogs, sheep, oil, coal and manufactured products of the state were included the total would be much larger. The purchasing power of the community is therefore great and while the cattle men and the oil men are complaining of the low prices, the bankers admit that most frozen loans have been thawed out and that their resources are now more liquid than they have been for some years.

A few of the more conservative are in fact fearful that the prevailing prosperity may lead to a revival of speculation in land which is the favorite investment here. As yet, however, there is no indication that such fears are justified and business throughout the Southwest appears to rest upon a very sound foundation.

The large expenditure for roads and the spread of co-operative marketing are the two things by which the observant traveler in the South will be most impressed. The good road mileage of the United States is already equal to its railroad mileage and it is being rapidly increased. The cost of the roads now being built will probably average about $25,000 a mile. This is about what our present railroads cost when they were constructed and we are therefore confronting a development which is quite as important in its economic significance as was the era of railroad building that ended about thirty years ago. It may be that the road building is being overdone, but this is questionable and while it lasts it is certain to provide work for many men and keep a lot of money in circulation.

The co-operative marketing movement is hardly less important for it is not only economically sound but is has been of great educational value in that it had led farmers to study commercial conditions and endeavor to adjust their production accordingly. For this reason an overproduction of cotton is unlikely in the future and while some increase in acreage next year may be expected it will probably be smaller than many anticipate.

Of last week's elections or their import as well as political conditions abroad, most business men and farmers seem comparatively oblivious. They are faithfully reported by the newspapers but they have been but little discussed for with cotton at 34 cents there is no consciousness of the economic disorder in Europe and there is but little interest in the November election day here because its popular verdict had been predetermined by the primaries held months ago.

Nor can any business significance be attached to the results of the elections in other parts of the country, though the passage of a soldiers' bonus in New York has strengthened the rather widespread feeling that Federal "compensation" cannot be defeated in the next Congress and that President Coolidge will not stand against the popular judgment.

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As for the Bavarian revolt and the other alarming developments in Europe, they are but the logical outcome of the course which France has pursued and as such have been foreseen by all thoughtful men for many months. Therefore, though German disintegration has gotten under way more rapidly than most people expected, its effects on this side the Atlantic have been to some extent discounted. Its worst result, so far as concerns the rest of the world, is that all hope of an effectual reparations conference is dashed, for with Germany on the verge of civil war and further French intervention probable the economists will have to retire to obscurity once more. The natural outcome will be a further decline in the foreign exchanges, particularly the franc, concerning which an able banker said last week that "at the first sign that the French peasants are hesitating to trust their savings to the government there is no telling where it will drop."

There is not much change in the domestic business situation. The stock market was very firm all last week, and its stimulating influence was widely felt, although confidence that it has passed bottom is by no means general. Close observers say the advance has not induced "the public" to buy stocks, which is another way of saying that prices have not gone low enough to compete with the other securities which have been offered in such huge volume and so well absorbed. That is all the significance which need be attributed to the stock market at present.

Trade indicia show a continued heavy movement of goods. There are a few notable laggards, including steel, in which production has slowed down further and price shading is reported. Some kinds of textiles are moving "slowly" also. But it must be remembered that the word "slowly" is used in comparison with the greatest volume of trade this country has ever known and that it is in no way related to the word "depression." The ground on which active business rests is still unshaken. Corn has sold at the highest price of the season despite an increase in the estimated yield and the fear that marketing the new crop would cause a dip. Wheat has been steady. Livestock prices have held up well in the face of heavy receipts. The California fruit growers and the sugar beet raisers are facing an unusually prosperous season. In conjunction with the high cotton prices it is evident that there is daily less cause for worry about the farmer's purchasing power.

October's statistics of building permits, showing an increase in leading cities of 19 per cent over September, bear out predictions that this mainspring of business is wound up to run all Winter. There is still nothing to cause concern in the money markets. If profits were more certain few business men could find legitimate ground for complaint, but most of them know that the gentle drop in prices of last Summer has had much to do with the maintenance of Fall trade and not many would want to exchange the exorbitant profits of a "boom" and the consequent collapse for the smaller but less variable gains of steady distribution.

And above all the tax collector, the uninvited and unwelcome guest at the business banquet, may be a little less exacting in the not distant future, for Washington reports indicate that the Administration will support a policy of tax reduction for 1924. It may or may not be accepted by the farm bloc group who hold the balance of power, but the fiscal condition of the Treasury will permit it and the sentiment in its favor will be enormous. It is hard to conceive of anything else which could so encourage and stimulate business.

The Future of the Merchant Marine

Necessity and ultimate realization of American ships unquestioned—Government's obligation in removing income tax from American business representatives abroad

By HERBERT HOOVER

IT IS simply a truism to say that we must have an American Merchant Overseas Marine. Entirely apart from the fine sentiment and national pride of a great trading nation in keeping its flag upon the seas, we must have our own ships for the protection of our foreign trade; we must have ships if we would expand our exports on sound lines and we must have them as an auxiliary to our national defense.

It seems worth repeating at times that our international trade is one of the very foundations of our standards of living; that our whole fabric of living and comfort is dependent upon the import of commodities which we do not and cannot ourselves produce—tin, rubber, coffee, sugar, and a score of others; further, in the main the amount of these commodities we can import will depend upon the volume we export. Moreover, we need a constant expansion of our export markets to give stability to our internal production by a wider range of customers.

If we are to have secure export markets, we must have some sound proportion of American controlled shipping to assure us against combinations in rates which would prejudice our goods in competitive markets. Nor have our merchants been without the experience of finding that the transport of our goods in foreign bottoms has been taken advantage of by our competitors to learn the details of our trade connections.

The Importance of Shipping Rates

The facility of the world in creating combinations in restraint of trade has been growing by leaps and bounds since the war and while we, as a nation, endeavor to curb these activities within our borders, there has naturally been no curbing of these activities abroad when they affect American interests.

Today, there are many commodities upon which we are dependent by import from foreign lands in which there are combinations in control of price in those foreign lands. Combinations in control of sea rates are the commonest thing in the world shipping fabric. Many of our raw material exports, such as wheat, are sold in the world market in competition with those of other countries, and the price level in these cases is the result of competitive streams that flow into these world markets. In wheat the farmer's return is fundamentally the price which he receives at Liverpool less the cost of transportation and handling. Therefore, any increase in shipping rates is in fact a deduction from the price to the farmer. It is just as important to him to be guaranteed reasonable rates of sea transport as of land freight. The real security is an American-owned Merchant Marine. In the long view the expansion of our foreign trade must and will take place in the export of larger proportions of manufactured goods. The primary requisite for such expansion is the assurance of regularity in transportation. Not only do we need regularity of sailings week by week, in order that the manufacturer may be assured in his problems of delivery, but our merchants and manufacturers require to know that when they have established their goods in foreign lands then regular transportation will be assured to them over years to come. They cannot be dependent upon hazards of foreign ship owners, allied as these owners are with foreign merchants and competitors.

Preparedness Against Foreign Wars

We must have especially regular and positive transportation under our flag on those great trade routes where our commerce can and will expand. Nor can America be dependent for her movement of overseas goods upon the make and break of peace and war in different parts of the world. We have had one gigantic national experience with this already. We must have ships under our own flag if we are to have security in our vital supplies and exports when other nations go to war with each other. As an auxiliary of our national defense we must have preparedness in transport for soldiers and supplies; we must have a training ground for our sailors, or our Navy itself would be helplessly confined to our own coasts.

In a broad sense the American people are endeavoring to establish a Merchant Marine that will adequately protect and promote our commerce. The ideal is regular, ferry-like service of boats of the cargo liner type with some passenger capacity traversing the great trade routes of the world and carrying at least 50 per cent of our foreign trade. Today, outside of oil, we are carrying less than 20 per cent. Some day we will attain such a merchant marine. Our national necessities, the capacity of our people for organization, for mechanical development and enterprise will some day bring it about. In the meantime we have much divided opinion in public mind, in the shipping world and in Congress, as to method. And our shipping world is suffering from great handicaps.

American Management Abroad

It is not my purpose to review all these handicaps that are so familiar to you, but rather to present to you one single phase that has not been so generally considered that is capable of remedy. That is the relationship that American merchants abroad must bear to the success of an American Merchant Marine. We will never have a real American Merchant Marine until we have a much larger complement of merchants of our own nationality conducting our commerce in foreign ports. Our raw materials are largely sold at our shores to foreign merchants. They dictate the shipping. Again most of our purchases of raw materials are for delivery at our shores. The foreign merchant again controls the shipping. If we except oil, most of our manufactured goods for export are dealt with by foreign merchants. How real all this is, is shown by the fact that except oil only about 12 per cent of our imports and exports were managed by American merchants abroad.

The situation is just as insecure for our exports as for our shipping. If we would make sure of the continuous flow of goods we must have the American on the ground distributing to the foreign retailer, securing business by his services as well as his price. Many an American merchant has seen his established trade disappear because he depended upon a foreign merchant not to show patriotism to his own country. This situation has been contributed to by the tendency of some of our manufacturers to regard export as a happy hunting ground in times of domestic depression, to be abandoned in times of domestic demand. We cannot have a Merchant Marine without an army of American merchants in foreign ports. This is the foundation of our British competitors.

No stable consumption of goods can be built upon on such a fabric. And other things being equal, the merchant ships his goods under his own flag, even giving a preference to that flag. Our competitors certainly do so. The lack of growth in our merchant personnel abroad is, I believe, to a large degree the fault of our Government for reasons I will detail later.

Despite our expanding export and import trade, the number of our merchants abroad has decreased in late years and yet if we would have a merchant marine they must be increased. The taxation policies of our Government have been to a considerable degree responsible for this situation.

The Heavy Tax Burden

We are asking our people to expatriate themselves in order to sell American goods and manage American ships. Our own Government demands in income and corporation taxes up to 58 per cent of the profits of our merchants resident abroad. They also pay taxes to the Government where they reside. Thus we demand that they pay double taxes. We are the only nation that does such a thing. With tax burdens even greater than ours, our competitors in the world today have freed their merchants resident abroad from this double taxation. For instance, an American merchant firm in London today must pay British taxes amounting directly or indirectly up to 50 per cent of his income. The American Government comes along and claims the same sum or even more. In countries not participants in the war, such as the Argentine, the British merchant pays no taxes to his home Government, whereas our merchant must pay his taxes in full.

It is, therefore, felt by many as more

An address delivered at the American Marine Congress, New York City, Nov. 8.

economic for Americans to stay at home and sell their goods in the Argentine through a German or a British merchant. Scores of our merchant firms, totally discouraged, have thrown up the sponge.

Few Engineers Now

Before the war, there were at least 1,000 American engineers employed at substantial salaries in the territories of our former allies. These men went abroad to install American methods, American machinery and equipment in the production of raw materials, and in transportation. These salaried workers now find themselves subject to two gigantic income taxes and thus their foreign mission is unprofitable. I doubt whether there are 100 of them left in foreign territories today. A vast amount of American machinery and equipment that followed in their wake has dried up.

There is one phase of this matter of vital importance to our farmers. Over 80 per cent of our agricultural exports go to Europe. Before the war European merchants bought stocks of wheat and grain during our Fall marketing season and thus assisted in financing the crop. They carried stocks in European warehouses thus relieving our congestion. Today, shortage of finance and credit leads them to buy from day to day and thrusts the burden of carrying the world's seasonal reserves either upon our own farmers or upon our merchants. If our merchant firms were established in Europe, it would be possible for them to give delivery at that end and to establish short credits to their customers—all of which would relieve our farmers. But American merchants are not likely to established in Europe and to pay two income taxes which might absorb up to 75 per cent of their income.

Another case of pertinent order is that on the China Coast. Inasmuch as China has no dependable corporation law, much Chinese capital is invested in foreign corporations under the management of, or in partnership with, Europeans. As foreign governments exact no home taxation from such corporations or their stockholders the Chinese naturally prefer them. We attempted to remedy this by Congressional authority to establish special American corporations under Federal authority but the restrictions are such that the act has failed its purpose. Three large American managed businesses have gone over to control of our competitors at a real loss to our foreign trade and the great discouragement of our merchants. Similar questions are arising in the Philippines.

Must Have Americans Abroad

I wish to repeat that if we are to secure the establishment of a merchant marine we must secure dispersion of the American merchant and our Government today is one of the most destructive influences in the whole matter. I do not wish to argue the theory that Americans who are engaged abroad in reproductive work should not bear their share of the national burden. I would only point out that other nations have found it is uneconomic to impose this burden upon them, and that we are left in a prejudiced position. Nor am I pleading the cause of the American expatriot, who prefers foreign civilization as a luxury, who is bringing no returns to his country by way of his savings or by way of his expansion of American trade.

These two groups are quite distinct. They can be distinguished in tax measures so as to apply the relief only to incomes earned abroad. One is tied passionately to his country's interests and the expansion of its welfare; America to him is the home he serves in managing her trade. He will yet return with his savings to add to the national wealth, whereas the other is but a pensioner on our national resources. And yet as a nation we penalize the one who brings us service and credit whereas we should lighten his burden as much as possible.

Notes on Washington Activities

By Paul Wooton

WITH the idea of unifying the specifications for machine screws, bolts and nuts, a special committee has been organized under the Federal Specification Board. The intention is to make possible the use by all Government agencies of the same nomenclature concerning the types of fits, tolerances and methods of gaging. Commander Miles A. Libbey, representing the Navy Department, is chairman of the committee. H. W. Bearce, representing the National Screw Thread Commission, is to be secretary of the committee. The other members are: Capt. J. M. Ward, representing the War Department; Capt. John T. West, representing the General Supply Committee; W. A. E. Doying, representing the Panama Canal. The first meeting of the committee is to be held Dec. 4.

In this connection, it may be mentioned that the work of the Federal Specifications Board is progressing rapidly. Ninety standards are ready for promulgation. Industry is being consulted in each case so that the new specifications may conform to the best commercial practice.

Circulation has been given a statement to the effect that the Board is eliminating the metric system from its specifications. This is being done only in those instances where it is not customary to furnish materials in metric units. The idea is to provide specifications in the system which is used currently for the particular material involved. Dr. G. K. Burgess, the director of the Bureau of Standards, is chairman of the Board.

The Stove Bolt Controversy

The National Screw Thread Commission has not given up hope that a national standard for stove bolts will be brought about. While it is apparent that the Commission is not impressed with the action of the Cleveland manufacturers in setting up the so-called Western standard, it is believed some means will be found to adopt a national standard under which machine screws and stove bolts can be completely interchangeable, despite the effort of the Cleveland manufacturers to consider the matter closed.

The Screw Thread Commission has been requested by New England manufacturers of stove bolts not to give its approval to any standard that is not consistent with the Commission's standard threads. New England manufacturers are circulating the following as a part of a statement to their customers: "The practice of makers of stove bolts heretofore has varied in respect to head, thread and actual diameter. The desirability of a common standard being recognized generally, effort has been made to establish such a standard through the co-operation of makers, users, Government authorities and scientific societies, but no standard has been adopted as yet by manufacturers generally or has been approved by the Government authorities or the scientific societies."

Specification Dictionary

Work is being crowded by the Department of Commerce on its dictionary of specifications. Sub-committees have been named to work along the lines of a classified system. The dictionary is the first step. In its final form it will be an encyclopedia of specifications.

Col. Peck's Committee

The work of the committee on Plain Limit Gages for General Engineering Work of the American Society of Mechanical Engineers is to be pushed vigorously this Winter, Col. E. C. Peck, the chairman of the committee announces. It is planned to hold the first meeting of the committee in New York, Dec. 4, when the annual meeting of the American Society of Mechanical Engineers is in session, thereby gaining by the co-operation that is sure to be obtained from that engineering association.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Screw and bolt making machinery and tools. Prague, Czechoslovakia. Purchase. Reference No. 8074.

Woodworking machinery and building construction machinery. Varese, Italy. Agency. Reference No. 8024.

Drilling machines and drills. Cape Province, South Africa. Purchase. Reference No. 8036.

Hack saw blades and other tools. Melbourne, Australia. Purchase. Reference No. 8040.

Forthcoming Meetings

National Founders' Association. Twenty-seventh annual convention. Hotel Astor, New York City, Nov. 21 and 22. J. M. Taylor, secretary, 29 S. LaSalle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, Dec. 3 to 6, in New York City. Calvin W. Rice, 29 W. 39th St., New York City, secretary.

National Exposition of Power and Mechanical Engineering. Second annual exposition to be held at the Grand Central Palace, New York City, Dec. 3 to 8. Headquarters, Grand Central Palace, New York City.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Some improvement in pig-iron inquiries. Bottom of market probably reached, so far as price of pig iron is concerned. Prices tending downward in light rails, forging billets, cold finished bars, black and galvanized steel sheets. Structurals firm at $2.50 base; soft steel bars, $2.40 per 100 lb., Pittsburgh. Tin plate firm. Accumulation of small orders keeping mills at 85 to 90 per cent of capacity.

Advances—Tin firm at present level; advanced 1⅛c. per lb. in week. Copper demand improving; price of electrolytic rose ⅛c. per lb. in New York. Lead market strong; up 5c. per 100 lb. since last week. Asiatic antimony scarce; ⅜c. per lb. higher in New York.

Declines—Bar iron, $3.10@3.15 per 100 lb. at mill, against $3.25 one week ago. Aluminum ingots, 25c. compared with 25½c. per lb. formerly. Old copper slightly cheaper in Cleveland. Zinc market quiet. No other declines reported.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	....
New York	5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.00
No. 12	3.10	4.64	3.80	4.05
No. 14	3.20	4.69	3.85	4.10
No. 16	3.40	4.79	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.95	4.45	4.70
Nos. 22 and 24	3.75	5.00	4.50	4.70
Nos. 25 and 26	3.80	5.05	4.55	4.75
No. 28	3.85	5.15	4.65	4.85
Galvanized				
Nos. 10 and 11	4.00	5.15	4.70	4.85
Nos. 12 and 14	4.10	5.25	4.80	4.95
Nos. 17 and 21	4.40	5.55	5.10	5.24
Nos. 22 and 24	4.55	5.70	5.25	5.40
No. 26	4.70	5.85	5.50	5.55
No. 28	5.00	6.15	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.55
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.65	3.90	4.55
Cold drawn flats, squares	5.15	4.40	5.05
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.50
Tin, 5-ton lots, New York			44.50
Lead (up to carlots), St. Louis	6.45@6.50	New York	7.17½
Zinc (up to carlots), St. Louis	6.37½	New York	6.80

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	27.00	26.50
Antimony (Chinese), ton spot	10.37½	10.50	10.50
Copper sheets, base	20.25	20.50	23.00
Copper wire, base	15.00	18.25	16.25
Copper bars, base	19.25	21.50	19.50
Copper tubing, base	23.00	26.50	23.00
Brass sheets, base	17.00	21.25	18.75
Brass tubing, base	21.50	26.25	20.50
Brass rods, base	14.75	17.25	15.75
Brass wire, base	17.50	21.25	....
Zinc sheets (casks)	10.25	10.45	....
Solder (½ and ½), (case lots)	29.50	29.00	28.50
Babbitt metal (83% tin)	52.00	52.00	45@48
Babbitt metal (35% tin)	25.00	17.50	20@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.25	11.25
Copper, heavy, and wire	10.75	10.75	10.50
Copper, light, and bottoms	9.50	8.75	9.50
Lead, heavy	5.75	5.25	5.75
Lead, tea	4.75	4.00	4.75
Brass, heavy, yellow	7.00	.. ..	7.00
Brass, heavy, red	8.75	9.25	8.75
Brass, light	6.25	5.00	6.00
No. 1 yellow brass turnings	7.00	5.75	6.50
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.14
Cotton waste, colored, per lb.	.08@.13	.12	.10½
Wiping cloths, 13¼x13¼, per lb	11.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	.. ..	52.00 per M	.16
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.98	1.05	1.14
Lard cutting oil (50 gal. bbl.) per gal	.55	.50	.67½
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.297	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5–2½	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	.. ..	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.50@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@5.50
White lead, dry or in oil	100 lb. kegs	New York,	14.00
Red lead, dry	100 lb. kegs	New York,	14.00
Red lead, in oil	100 lb. kegs	New York,	15.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.0465	0.0465	0.039
Brass rods	per lb.	0.1475	0.1525	0.17
Solder (½ and ½)	per lb.	0.295	0.295	0.275
Cotton waste	per lb.	.10@.13	.10@.13	.09@.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.60
Machine oil	per gal.	0.297	0.297	0.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	40–10%	40–10%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40–10%	60%	45–5%
1⅛ and 1¼x3 in. up to 12 in.	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	25–10%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30–10%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	40–10%	.....	60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	30–10%	50%	40–5%
Bolt ends, with hot pressed nuts	40–10%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 9/16 and smaller	60%	.....	.....
Semi-finished nuts, ⅝ and larger	55%	70%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, sq., per 100 lb. Off list	0.50	3.50	2.50
Nuts, cold punched, hex., per 100 lb. Off list	0.50	3.50	2.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50–10%	60%	60%
Rivets, tinned	50–10%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3.60	$3.75
Cone heads, ditto (net)	5.60	3.80	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

New and Enlarged Shops

Machine Tools Wanted

Ala., Albany—Decatur Cornice & Roofing Co., Inc., H. R. Davis, Secy.—No. 17 E punch, new Doty, 16 in. throat, capacity ⅜ in. through ¾, direct motor drive; No. 17 E shear, new Doty, 16 in. throat, capacity 2 in. round with shearing attachments for rounds, squares, flats and angles, direct motor drive; two W. F. & J. Barnes Co. No. 5 drill presses, one 20 in. and one 26 in. swing; power hacksaw for 24 in. blades, swivel vise for bevel cutting; Reliance or Landis bolt and pipe threading machine, capacity ½ to 2½ in. bolts, ¾ to 2½ in. pipe; quick acting light power punch; 16 in. turning lathe, 5 ft. travel; light high speed drill, friction drive from band, no gears; pipe bending machine up to 2½ in. pipe; one hand operated crane, 50 ft. span, with 1 to 6 ton electric hoist, lift 22 to 25 ft., both bridge member and trolley to be hand operated; one single carriage, ten ton capacity and one 2 to 5 ton carirages, 2 to 5 ton hoists, electrically operated, 50 ft. span, lift 25 ft. crane, 220 volt, 3 phase, 60 cycle, a.c., operated on open runway.

Conn., Hartford—J. A. Pilgard, 1026 Main St.—complete equipment and tools for machine shop of new garage.

Conn., Stamford—H. H. Noack, Forest St.—machinery and equipment, including lathe, planer, drills, bench tools, shafting, pulleys and belting, for proposed garage.

Fla., Bradentown—Bradentown Sales Co.—lathe, drill press and bench tools for automobile repairs.

Ill., Chicago—Chicago, Rock Island & Pacific R.R., La Salle St. Sta., F. D. Reed, Genl. Purch. Agt.—motor driven 24 in. heavy duty lathe, 7½ in. hole through spindle.

Ill., Chicago—Illinois Central R.R., 135 East 11th Pl., J. J. Bennett, Purch. Agt.—motor driven upright drill, 36 in. table, to drill 2½ in. holes.

Ia., Odebolt—E. D. Peck & Son—20 in. drill press, air compressor, chain hoist and gasoline service pumps for garage.

Kan., Galena—J. Hoffman—lathe, about 20 in. swing, for blacksmith and machine shop (used).

Kan., Galena—Jaqueth & Loucks—lathe for garage.

Kan., Galena—C. N. Outt, West Side Garage—lathe and drill press.

Kan., Galena — Stone & Penson, F. T. Stone, Purch. Agt.—lathe for sheet metal work.

Kan., Wichita—Moore Bros. Electric Co., 215-217 West Douglas St.—lathe and milling machine.

Me., Portland—E. W. Jones, Exchange St.—lathe, planer, upright drill, hacksaw, pipe cutters and threaders, shears, drills, reamers, miscellaneous small tools, pulleys, belting and shafting for proposed $50,000 garage.

Me., Portland — Portland Terminal Co., Union Sta., T. B. Wheeler, Ch. Engr.—machinery and equipment for new $1,500,000 locomotive repair shop.

Md., Baltimore — G. Esselmann, 3313 Greenmount Ave.—automobile repair machinery, lathe, drill press and bench tools.

Mass., Boston—W. J. Connell Co., 574 Commonwealth Ave.—small garage tools, shafting, pulleys, belting, upright drill, shears, punches, hacksaw, reamers, pipe and bolt dies, etc., for proposed garage.

Mass., Worcester—Curtis & Marble Machine Co., 100 Fremont St.—large and small machine tools, including lathes, planer, shaper, drills, reamers, shears, etc., for $20,000 addition to shop.

Mich., Detroit—Buhl Sons, foot of Adair St.—automobile repair equipment for proposed $55,000 garage.

Miss., Utica—J. B. Arnold Motor Co.—lathe and drill press.

Mo., Webb City—T. H. Stepp, Daugherty and Walker Sts.—drill press and lathe (used).

N. Y., Barneveld—T. Haskell—vise, tools, press, emery wheel and equipment for garage repair shop.

N. Y., Buffalo—H. C. Amidon, Central Y. M. C. A.—equipment for garage repair shop.

N. Y., Buffalo—L. Doebert, 352 Pratt St.—tools, vise, presses and equipment for new garage.

N. Y., Buffalo—J. Fourrier, 200 Dewitt St.—garage repair shop equipment.

N. Y., Buffalo—M. Grossman, 15 Mortimer St.—equipment for garage and repair shop.

N. Y., Buffalo—J. King, 1185 Niagara St.—equipment for garage repair shop.

N. Y., Buffalo—G. Kranchfeld, Spring and Sycamore Sts.—equipment for garage repair shop.

N. Y., Corning—Hood Fdry., Front St., A. G. Hood, Purch. Agt.—lathe, emery wheel, stand, belting, grinding machine and equipment for machine shop; also machinery and tools for carpenter shop.

N. Y., Geneva—O'Malley Motor Co., 347 Exchange St., R. O'Malley, Purch. Agt.—complete equipment, including tools, lathe, emery wheel and presses for proposed $100,000 garage, to replace that which was destroyed by fire.

N. Y., Jamestown—East 2nd St. Garage, P. Ogren, Purch. Agt.—drill press, tools and equipment for garage and repair shop.

N. Y., Mayville—Service Garage, S. W. Houx, Purch. Agt.—garage tools and equipment, including bench tools, press and emery wheel.

N. Y., Niagara Falls—United States Light & Heat Co., Highland Ave. (manufacturer of motors, batteries, etc.)—machine shop tools, machinery and equipment, to replace that which was destroyed by fire.

N. Y., Richmond Hill (Jamaica P. O.)—Auto Table Co., Inc., 120th St. and Jamaica Ave.—punch, shear and angle cutting combined for handling iron up to ½ in. thick; one 8 ft. press.

N. Y., Schenectady—Westinghouse Co., 56 Weaver St. (manufacturer of thrashing machines)—hangers, pulleys, special machinery, gear cutting, grinding and automatic drilling machines, also presses for new plant at Shortsville.

N. Y., Seneca Falls—F. Maier, 193 Fall St.—complete machinery and equipment for the manufacture of Star lathes.

N. Y., Sheriden—Sheriden Garage—small lathe, tools and machine shop equipment.

N. Y., Syracuse — Borgenson Tool Co., Water and Grape Sts.—machine tools, including special, slotting, cutting off, chucking, automatic milling and screw machines.

N. Y., Syracuse—Diefendorf Gear Corp., 324 Pearl St., W. H. Diefendorf, Pres.—machine tools, automatic milling, drilling, boring, gear cutting, grinding, etc., to enlarge capacity.

N. Y., Syracuse—H. A. Smith Mchy. Co., Water and Grape Sts.—complete machinery and equipment, including automatic drilling and screw milling tools and lathes.

N. Y., Utica—J. Cox, 408 Cooper St.—complete equipment, drill press and small lathe for garage and repair shop.

O., Akron — Farmers Sanitary Strainer Co., F. B. Young, Pres. — machine shop equipment, including drill press and grinder.

O., Akron—Summit Tractor Co., 202 East Mill St., H. D. Korte, Mgr.—general machine tools, including small lathe, automatic drilling machine and grinder.

O., Bridgeport—Hill Machine Shops—complete equipment, tools and lathes for proposed machine shop.

O., Columbiana—H. Dill—pipe threading and cutting machine, tools and equipment for plumbing shop.

O., Columbus — Columbus Steam Pump Wks., 83 West Broad St., R. Pulling, Pres.—automatic punch machine, grinder, etc.

O., Delta—Markey & Belprez (brass foundry and machine shop), E. V. Markey, Pres.—small lathe, drill press and foundry equipment.

O., Youngstown—Youngstown Boiler & Tank Co., 1054 Mahoning St.—drill presses, cranes, hoisting machinery and drilling machines.

Pa., Altoona—H. H. and H. M. Fleck, 1409 13th Ave.—tools, press, emery wheel and equipment for proposed garage.

Pa., Altoona—William Penn Auto Co., 2208 Union Ave., R. P. Miller, Purch. Agt.—drill press, vise, small lathe and repair tools.

Pa., Corsopolis—Advance Welding Co., S. Crute, Purch. Agt.—welding outfits, machinery and tools for welding and repair plant.

Pa., Edwardsville (Kingston P. O.)—R. Lloyd, Durkas Bldg., (battery repair shop)—tools, press, charging and general repair equipment.

Pa., Erie — H. P. Westcott, Pittsburgh Ave.—machinery and tools for proposed $35,000 machine shop.

Pa., Johnsonburg—Johnsonburg Machine Co. (manufacturer of iron, steel and brass parts), R. E. Dempsey, Purch. Agt.—special machinery, machine shop tools and equipment.

Pa., Kingston (Wilkes-Barre P. O.)—Davenport Garage & Service Sta., C. M. Whitesell, Purch. Agt.—tools, emery wheel, presses and battery station equipment.

Pa., Miners Mills (Wilkes-Barre P. O.)—S. Jacobs—tools, equipment and emery wheel for new garage.

Pa., Pittsburgh — Beechwood Garage, Beechwood Blvd., S. Neuman, owner—tools and repair equipment.

Pa., Pittston—Motorin Garage, Tompkins St., W. J. Gillespie, Purch. Agt.—complete equipment, including small lathe and repair tools, for proposed garage.

Pa., Scranton—Paige Motor Co., Anderson Bldg., Adams St.—equipment, garage repair tools, press, etc.

Pa., Somerset—A. B. C. Motor Co.—tools, press and equipment for new garage.

Pa., Titusville—City Hall Garage Co., W. C. Jones, Purch. Agt.—tools, presses and equipment for garage.

Pa., Wilkes-Barre — M. Desiderio, Lawrence St.—10 to 12 in. lathe, press, tools and machine shop equipment.

Pa., Wilkes-Barre—J. Silverblatt, 94 Bennett St.—equipment, press, tools and emery wheel for garage and repair shop.

Tex., Fort Worth — J. J. Longever, 290 West 11th St.—electric drill press.

Va., Norfolk — Norfolk Southern R.R., L. M. Jones, Purch. Agt.—24 in. lathe and 6 ft. radial drill.

Wis., Appleton — Appleton Pattern Wks. Co., c/o B. F. Wachholtz, Mgr.—special machinery and equipment for wood and metal patterns and templates.

Wis., Milwaukee—Adjustable Rack Co., c/o F. A. Brown, 2801 Center St. (manufacturer of shoe racks)—boring machine and drill press.

Ont., Welland — Gram Bros. — complete equipment for proposed $40,000 garage.

Que., Hull—Hull Steel Fdrys. Co. (manufacturer of railroad equipment), A. H. Coplan, Pres.—machinery, equipment, furnaces, power hammers, etc., for proposed $1,000,000 steel mill at Ogdensburg, N. Y.

Que., Longueuil—Cote & Montcalm, 2 St. Charles St.—tools and equipment for garage and repair shop.

Que., Montreal — Anctil & Burnell, 50 Workman St.—small lathe and tools for automobile repair shop.

Que., Montreal—Cylinder Grinding & Auto Part Co., Ltd., 146 Mountain St.—hacksaw, threading machine, etc.

Que., Montreal—Duplessis, Bezier & Valiquet, 27 St. Alexander St.—tools, lathe, drill, etc., for automobile repairs.

Que., Montreal—Emery Steel Co., Ltd., c/o H. S. Ross, 90 St. James St.—equipment for foundry and machine shop.

Que., Montreal—A. Fleurant, 142 Murray St.—drill press, emery wheel and stand for blacksmith shop.

Que., Montreal—J. A. Houle, 765 Laurier Ave.—drill press and lathe for automobile repairs.

Que., Montreal—Jarry & Frere, 2914 St. Lawrence St.—lathe, press and bench tools for garage.

Que., Montreal—E. Lamarche, 106 Baldwin St.—equipment for garage.

Que., Montreal—M. Mongeau, 321 Aylwin St.—equipment for garage and repair shop.

Que., Montreal—Montreal Auto Repairs, 1446 St. Lawrence Blvd.—tools, press and equipment for automobile repair shop.

Que., Montreal—Natl. Welding Co., 563 St. Timothee St.—shears, upright drill, etc., for automobile repair shop.

Que., Montreal—Paiement & Frere, 439 Joliette St.—drill press and lathe for garage.

Que., Montreal—J. Therrien, 576 Ontario St., E.—reamer and small hand tools for machine shop.

Que., Montreal—L. Tremblay, 7 Brebeuf St.—press, tools and equipment for garage.

Que., Montreal—Savaria & Lettre, 1581 St. James St.—lathe, planer, etc., for automobile repairs.

Que., Montreal, East—A. Lavigne, 33 Derocher St.—equipment and tools for repair shop and garage.

Que., Pointe aux Trembles—A. Bilodeau, 5493 Notre Dame St.—emery wheel, drill press, tools, etc., for automobile repair shop.

Que., Quebec—R. Gauvin, 1 D'Aiguillon St.—garage and repair equipment.

Que., Quebec—G. Legace, 66 Charest St.—tools, press, etc., for garage.

Machinery Wanted

Calif., Los Angeles—Amer. Crushed Rock Co., Amer. Bank Bldg.—rock crushing plant for Claremont. Estimated cost $100,000.

Fla., Lakeland—N. P. Cauthen—lathe for turning broom handles.

Ga., Atlanta—R. B. Blackburn, Atlantic Trust Bldg.—machinery for the manufacture of tags for cotton bales.

Ill., Chicago—Duplex Printing Press Co., 536 Rush St., C. S. Brown, Purch. Agt.—8 page duplex press.

Ill., Chicago—Florsheim Shoe Co., 3927 Belmont St.—complete machinery and equipment for proposed $700,000 addition to plant.

Ill., Chicago—Harvard Press, 1213 West Van Buren St., M. Mehincoe, Purch. Agt.—12 x 18 in. Miller job press and a 10 x 15 in. Gordon press.

Ill., Chicago—Vulcan Co., 4036 West Lake St. (contractors)—metal grinder, surfacer and planer for woodwork.

Ill., Marissa — R. W. Randolph — job printing press for electric power, belting, hangers and pulleys (used).

Ind., Indianapolis — Indianapolis Wood Products Co., 204 Lombard Bldg.—bandsaw and slotting machine.

Ind., Spencer—The Journal — Babcock press.

Ia., Sigourney—F. C. Parke—10 x 15 in. Chandler & Price job printing press.

Ia., Stratford—Courier Publishing Co.—9 x 13 in. Gordon job printing press.

Kan., Galena—Electric Shoe Shop, 403 Main St.—shoe stitcher and finisher (used).

Kan., Galena—W. L. Hardman—dustless shoe finisher and stitcher.

Kan., Galena—A. L. Morford, 207 Main St.—Miller feeder, job press and paper cutter (used).

Kan., Galena—R. B. Tennis, 506 Main St.—electric shoe finisher, also combination shoe and harness stitcher.

Md., Baltimore—Porcelain Enamel & Mfg. Co., 8th Ave. and O'Donnell St.—special machinery and equipment for proposed $400,000 addition to plant.

Mass., Boston—Berwick Cake Co., 2220 Washington St., C. T. Main, 220 Devonshire St., Purch. Agt.—machinery and equipment, including ovens, conveying machinery, etc., for proposed $150,000 bakery.

Mass., Boston — The city, Public Bldg. Dept., F. J. Kneeland, Chn.—machinery, including wood and meta, working machines, benches, shafting, belting and pulleys, for manual training department of proposed $500,000 grammar school.

Mass., Boston—Fuller-Thurber Co., 414 Albany St. (planing mill)—pulleys, shafting, belting and possibly machinery.

Mass., Campello (Brockton P. O.)—Howard Press, Inc.—15 x 21 in. Golding job press (used).

Mass., Fall River—City Bldg. Dept.—machinery, including wood and metal working tools, tables, benches, shafting, pulleys and belting, for manual training department of proposed junior high school.

Mass., Fall River—Union Cottor Mfg. Co.—looms, shafting, pulleys, etc., for addition to mill.

Mass., Hinsdale—Hinsdale Woolen Mills, address manager—picking, carding and warping machines.

Mass., Lowell—International Cotton Mills, Marginal St.—looms, shafting, pulleys, etc.

Mass., Newburyport—Essex Cotton Mills, address manager—shafting, belting, pulleys, etc., possibly a few looms.

Mass., Southbridge — Hamilton Woolen Mills, address purchasing agent—machinery for proposed 3 story, 50 x 150 ft. addition.

Mass., West Roxbury (Boston P. O.)—L. S. Crosby, 61 Dent St.—medium size power hammer for machine shop (used).

Mass., Worcester—Osgood, Bradley Car Co., 351 Mountain St., address purchasing department—forge equipment for new $40,000 shop.

Mich., Detroit—Consolidated Bakeries Co., c/o R. R. Pereira, Archt., 333 State St.—bread baking and handling machinery for proposed $75,000 baking plant.

Mich., Redford—W. Gitchel, R. F. D. 3—medium or large paper cutter (used).

Mich., Sault Ste. Marie—Soo Handle & Enameling Co.—wood turning machinery and complete outfit for enameling on metal, to replace that which was destroyed by fire.

Minn., Duluth—Cutler-Magner, 1115 Fidelity Bldg.—machinery for proposed $400,000 salt refinery and warehouse.

Miss., Jackson—Enochs Lumber Mfg. Co. (sash and door factory)—complete machinery for proposed plant, to replace that which was destroyed by fire.

Mo., Cameron — B. B. Witt (newspaper and job printer)—model 1 linotype machine.

Mo., Carterville—Byers, 407 West Main St.—tinner's brake (used).

Mo., St. Louis—Chester Knitting Mills, Vanderventer and Laclede Sts.—machinery and equipment for plant for the manufacture of hosiery at Gadsden, Ala.

Mo., St. Louis—Puritan Co., 6111 Harlan Pl.—job printing press.

Mo., Webb City—J. Carbon, 4th and Oakland Sts.—electric finisher, stitcher, belting, pulleys and hangers for shoe repair shop.

Mo., Webb City — K. M. Ross, 310 North Hall St. (leather shop)—stitcher, finisher, belting, hangers and pulleys (used).

N. Y., Akron—Donex Co.—machinery for the manufacture of tennis rackets and lawn furniture, to replace that which was destroyed by fire.

N. Y., Binghamton—Hullman Furniture Co., 221-225 Washington St., I. J. Hullman, Purch. Agt.—machinery and equipment for the manufacture of wood furniture, including bench tools and lathes.

N. Y., Brownville—Brownville Board Co. (manufacturer of wall board)—machinery for pulp mill to replace fire loss.

N. Y., Buffalo—P. J. Cahill, 128 Chester St.—bakery equipment.

N. Y., Buffalo—R. H. Childs, 345 Niagara St.—candy making equipment.

N. Y., Buffalo—K. Falter, 2281 Genesee St.—bakery equipment.

N. Y., Buffalo—G. E. Farthing, 86 Ellicott St.—printing office equipment for proposed plant at 260 Oak St.

N. Y., Buffalo—A. J. Feyl, 1274 Genesee St.—candy manufacturing equipment for factory at 42 Harriett St.

N. Y., Buffalo—K. Henzl, Bailey St. and Littell Ave.—carpenter shop equipment.

N. Y., Buffalo— J. E. Kieffer, 1299 Hertel Ave.—equipment for bakery.

N. Y., Buffalo—A. Koch, 720 West Ave.—bakery equipment.

N. Y., Buffalo—Luther Bros., 52 Warwick Ave., C. Luther, Purch. Agt.—carpenter shop equipment.

N. Y., Buffalo—F. Ponczkowski, 2 Empire St.—equipment for the manufacture of sausage.

N. Y., Buffalo—G. J. Stavros, 291 Ellicott St.—candy manufacturing equipment for factory at 852 Tonawanda St.

N. Y., Buffalo—A. Szlagowski, 152 Milburn St.—grinders, cutters and equipment for addition to sausage factory.

N. Y., Burt—Henner Evaporating Plant, Creek Rd., H. Henner, Webster, Purch. Agt.—complete machinery and equipment for fruit evaporating plant.

N. Y., Dunkirk—Roamer Axe & Tool Co., J. C. Roamer, Purch. Agt.—machinery and equipment for the manufacture of axes and tools.

N. Y., Green Island (Troy P. O.)—J. A. Manning Paper Co., W. L. Eldred, Purch. Agt.—six beaters.

N. Y., Holley—R. Sarmsworth—refrigeration equipment for cold storage plant, to replace that which was destroyed by fire.

N. Y., Lowville—Power Gas & Oil Co., A. N. Virkler, Purch. Agt.—pumps and equipment for gasoline stations.

N. Y., Niagara Falls — Cataract Ice Cream Co., Niagara St.—machinery and equipment for addition to plant.

N. Y., Norwich—M. Devine—machinery and equipment for the manufacture of cigars, to replace that which was destroyed by fire.

N. Y., Peekskill—Union Stove Wks.—complete machinery and equipment for proposed $500,000 plant, to replace that which was destroyed by fire.

N. Y., Potsdam—St. Lawrence Condensed Milk Corp., R. B. Page, Pres.—machinery, equipment, ha..gers and pulleys for milk plant ,to replace that which was destroyed by fire.

N. Y., Rhinebeck—Rhinebeck Gazette—model 14 linotype machine.

N. Y., Seneca Falls — Seneca Rug Co. Inc., 12 Swaby St., F. Marcella, Purch. Agt.—complete machinery and equipment for proposed $60,000 factory.

N. Y., Utica—Utica Knitting Co., Erie St.—machinery for proposed factory for the manufacture of steel boxes.

N. Y., Watertown — Watertown Radio Service Co., 112 Park St., J. Purser, Purch. Agt.—machinery for small plant for the manufacture of radio and electrical apparatus.

N. C., Littleton — E. E. Wollett—fast feed planer and other planing mill machinery.

N. C., Rutherfordton—Taylor Lumber Co., J. L. Taylor, owner—complete outfit for general mill work.

N. D., Parshall—Plainsman—2 page cylinder newspaper press.

O., Bridgeport—Scott Lumber Co.—complete machinery for proposed planing mill, to replace that which was destroyed by fire.

O., Columbus—Henderson Tire & Rubber Co., Goodale St. along tracks of Hocking Valley R.R., C. O. Henderson, Pres.—five tire making machines and one tubing machine.

O., Corning—Consolidated Clay Products Co.—clay working machinery and equipment, to replace that which was destroyed by fire.

O., Dayton — Aero Sign Service Co. McDaniel Ave., W. P. Hartsock, Purch. Agt.—machinery and equipment for the manufacture of electric signs.

O., Dover—Sugarcreek Brick Co., H. A. Rinker, Genl. Mgr.—general brick making equipment.

O., Lima — Lima Glass Co., Pearl and Union Sts.—machinery and equipment for proposed $50,000 glass plant.

O., Lima—Parks & Klay Co., South Pine and St. Johns Sts., S. G. Parks, Purch. Agt.—gasoline pumps and service station equipment for proposed expansion program.

O., Toledo—W. Zeunen, 507 Front St.—electric welding outfit and equipment for welding shop.

O., Warren — East Ohio Mfg. Co., B. Shover, Oliver Bldg., Pittsburgh, Purch. Agt.—one 25 ton, 3 motor, industrial crane.

Okla., Rush Springs — Rush Springs Record—No. 8 or 14 linotype machine.

Ore., Portland — Triangle Milling Co., Tillamook St.—milling, cleaning, conveying machinery, belting, etc.

Pa., Allentown—Pennsylvania Independent Oil Co., P. L. Price, Purch. Agt.—equipment and pumps for proposed branch service stations.

Pa., Columbia Cross Roads—C. E. Peckham—complete sawmill machinery and equipment, to replace that which was destroyed by fire.

Pa., Dawson—Corrado Coal Co., Fort Hill—coal handling equipment, tipple machinery, etc.

Pa., Homestead—Acme Steel Constr. Co., G. L. Redpath, 107 3rd Ave., Purch. Agt.—machinery and equipment for the manufacture of iron, steel and metal products.

Pa., Montgomery — United Buyers Mfg. Co.—machinery for the manufacture of small wheel toys at Williamsport.

Pa., Pittsburgh—Anchor Drawn Steel Co., 1101 Farmers Bank Bldg.—cranes.

Pa., Pittsburgh — A. M. Byers Co., 235 Water St. (iron pipe)—one electric gantry crane for South Side Wks.

Pa., Pittsburgh — Carnegie Steel Co., Carnegie Bldg.—two 75 ton and three 10 ton cranes; also one hand operated crane for McCutcheons Wells, Reedsdale St., N. S.

Pa., Pittsburgh—Crucible Steel Co., Oliver Bldg.—cranes for expansion of Park works.

Pa., Pittsburgh—Eagle Soda Water Co., 3206 Niagara St.—charging machinery and equipment for addition to plant.

Pa., Pittsburgh—Jones & Laughlin Steel Corp., 3rd and Ross Sts., A. Ochsenhirt, Purch. Agt — one locomotive type dock crane, 75 ft. boom, for Memphis, Tenn.

Pa., Pittsburgh — Pennsylvania R.R., Union Arcade, W. G. Phelps, Purch. Agt.—one 20 ton locomotive crane for Sharpsburg.

Pa., Youngsville — H. Trask (manufacturer of furniture)—woodworking machinery including lathes, stickers, saws, belting, hangers and pulleys.

S. C., Hardeeville—H. B. Rivenbark, P. O. Box 27—machinery for the manufacture of hosiery.

Tenn., Chattanooga—Chattanooga Roofing & Fdry. Co., Masonry Ave. along tracks of Nashville, Chattanooga & St. Louis Ry.—brass foundry equipment.

Tenn., Columbia—Non-Acid Phosphate Co.—equipment, etc., for the reduction of phosphate rock.

Tenn., Nashville—The city—refrigeration plant for market house.

Tenn., Nashville—Equipment Sales Co., Independent Life Bldg. — jaw crusher, medium size.

Tex., Dekalb—Crump Motor Co.—electric drill.

Tex., DeKalb—Jolly Printing Co.—24 x 36 in. folder.

Tex., Kaufman—J. Keith (cabinet maker) —8 in. jointer and Universal woodworker.

Tex., Lubbock—The Printer, Box 966—10 x 15 in. job printing press.

Tex., Marlin—E. Undersmith, 302 Fortune St.—two job printing presses.

Tex., Mission—S. W. McClure—newspaper press, belting, pulleys, hangers and shafting.

Tex., Whitney—O. D. Harris (machine shop)—trip hammer, Universal woodworker and belt sander.

Va., Front Royal—Major Constructing Co.—brick making machinery (used preferred).

Va., Richmond—The city, E. W. Trafford, Dir. Public Utilities—motor driven portable belt conveyor.

Wis., Arpin—J. Ganzley—churn, separator, etc., for proposed $40,000 creamery, to replace that which was destroyed by fire.

Wis., Beaver Dam—G. E. Welson—vegetable canning machinery, including sorters, viners, conveying, cooking, belting, shafting and hangers.

Wis., Beloit—E. R. Branigan, 398 Eclipse Ave.—ice making machinery for proposed $40,000 ice plant.

Wis., Beloit—W. A. Rossow, 4th St.—equipment for proposed $40,000 laundry.

Wis., Birchwood—Clover Valley Cheese Co.—separators and vats.

Wis., Birchwood — Weigor Hardwood Products Co.—planer, matcher and bandsaw.

Wis., Fond du Lac—H. & H. Cafeteria Co., 105 South Main St., E. C. Halverson, Mgr.—ice machine and refrigeration machinery, brine type.

Wis., La Crosse — The city, c/o C. C. Congdon, Engr., City Hall—level, transit and blue printing machine for engineering department (new).

Wis., Madison—Chicago & Northwestern Ry., 201 South Blair St., B. R. Kulp, Division Engr.—electric hoist for switching yards.

Wis., Madison—N. Olsen, 1928 Railroad St.—bench tools, small woodworking machinery, band and circular saws.

Wis., Madison—G. Ripp & Son, 20 South Bassett St.—8 in. molder, turning lathe, jointer and dry kiln equipment.

Wis., Marathon — Marathon Concrete Wks., C. Kersten, Purch. Agt. — tamping machines, also moulding machine.

Wis., Mayville—Feilbach Mfg. Co., A. O. Feilbach, Mgr.—equipment and tools for the manufacture of metal specialties.

Wis., Milwaukee—Advance Boiler & Tank Co., 3015 Walnut St., E. J. Lepinsky, Purch. Agt.—one boiler maker's flanging machine.

Wis., Milwaukee — Christophel Concrete Products Co., Greene Bay and Cedarburg Rds., J. Christophel, Purch. Agt.—tamping machine, multiple tampers.

Wis., Milwaukee—E. F. Goss, 935 Clinton St. (foundry)—one 20 to 25 ton electric traveling crane.

Wis., Milwaukee—A. Lohberger, 1250 25th St.—power cake mixer, dough trough and sifter for bakery.

Wis., Milwaukee—Pittsburgh Plate Glass Co., 205 Lake St., L. Patton, Purch. Agt.—one traveling crane, about 5 ton.

Wis., Milwaukee—P. J. Ries, 809 35th St. (printer)—20 to 24 in. paper cutting machine.

Wis., Racine—Belle City Malleable Iron Co., Kewaunee St., C. S. Anderson, Mgr.—annealing equipment for proposed $45,000 addition.

Wis., Rice Lake—Battery Box Mfg. Co., 209 Knapp St., M. A. Paulson, Purch. Agt. —dove-tailing machine and matcher.

Wis., Sheldon — Bd. Educ., T. Bennett, Clk.—woodworking equipment, bench tools, etc., for manual training department in new school.

Wis., Shullsburg—Northern Mines Co.—mechanical shovel loader and conveying machinery.

Wis., Stetsonville — Stetsonville Welding Co., Box 1—oxyacetylene welding equipment, either cylinder or generator.

Wis., Wales — R. Lathe — equipment, forges, anvils, etc., for new blacksmith shop.

Alta, Edmonton—Alberta Refineries, Ltd., W. B. Stewart, Dir.—refinery and producing equipment for new oil plant.

B. C., Port Alberni—Yellow Fir Lumber Co., Ltd.—sawmill equipment for plant at Great Central Lake.

Ont., Acton—Acton Machine Co., F. S. Blow, Mgr.—metal working machinery for the manufacture of specialties and general repairs.

Ont., Port Colborne—Marine Welding & Boiler Co., J. Sherk, Mgr.—equipment for proposed additions to plant.

Ont., Ridgetown—Canada Wood Products Co.—machinery and equipment for the manufacture of wood specialties.

Ont., Schumacher—McIntyre Porcupine Mines, Ltd., R. J. Innes, Mgr.—mining plant to carry work to 5,000 or 6,000 ft., also additional unit to present 1,000 ton mill.

Ont., Tilbury—Southern Ontario Gas & Oil Co.—equipment for handling gas and oil.

Ont., Toronto — Chapmans Ltd., 330 Gerard St., E.—ice manufacturing machinery and equipment for proposed $75,000 plant.

Ont., Walkerville — Villeneuve Lumber Co., Ltd.—planing mill equipment.

Que., Amos—Dubuisson Mining Co., Ltd., W. Norris, Purch. Agt.—complete development equipment.

Que., Bout de l'Isle—D. Delorme—emery stand and wheel for blacksmith shop.

Que., Montmagny—Canadian Heating Apparatus Fdry., Ltd.—C. A. Paquet, Dir.—complete foundry equipment.

Que., Montreal—Courtaulds Ltd., C. R. Tetley, 314 Beaver Hall Hill, Purch. Agt.—about $750,000 worth of machinery for proposed silk plant at Cornwall, Ont.

Que., Montreal — J. Sauveur, 632 St. Lawrence Blvd.—complete equipment for blacksmith shop.

Que., Prefontaine—Seaman, Kent & Co., Ltd.—complete sawmill machinery to replace $200,000 fire loss.

Que., Quebec—P. Auclaire, Notre Dame de Lourdes St. (sash and door factory)—sander.

Que., Quebec — C. Jefferson, 12 Cartier Ave.—compressor and garage tools.

Que., Quebec — O. Lachance, 128 Lalibertie St.—emery wheel, stand, tire shrinker, etc., for blacksmith shop.

Que., Quebec—P. Lapointe, 3 St. Francis St.—bench tools, tire shrinker, etc., for blacksmith shop.

Metal Working Shops

Calif., Fresno—C. H. Cobb, c/o Trewhitt-Shields, Rowell Bldg., Contrs., awarded the contract for the construction of a garage on Forthcamp St. Estimated cost $52,000.

Calif., Los Angeles—The Southern Pacific Ry. Co., 5th St. and Central Ave., will soon receive bids for the construction of an 80 x 500 ft. locomotive erecting shop to contain about twenty-four engine pits, equipped with 200 ton and two 15 ton traveling cranes, on Alhambra Ave. Cost will exceed $300,000. G. W. Boschke, Ch. Engr. Noted July 19.

Calif., San Francisco—The Meyers Safety Switch Co., 575 Howard St., awarded the contract for the construction of a 1 story factory on Tehama St. near 5th St. Estimated cost $7,940.

Calif., Sausalito—C. Mason, El Monte Lane, awarded the contract for the construction of a 2 story garage on Water St. Estimated cost $50,000. Noted Nov. 8.

Conn., Bristol—Truden & Platt, Inc., 67 Prospect St., awarded the contract for the construction of a 1 story, 60 x 70 ft. garage and office building. Estimated cost $40,000. Noted Oct. 25.

Ill., Chicago—V. A. Hackel, 6827 Creiger Ave., awarded the contract for the construction of a 1 story, 150 x 190 ft. garage at 7221-39 Exchange Ave. Estimated cost $65,000.

Ill., Chicago—**D. S. Klafter**, Archt., 64 West Randolph St., is receiving bids for the construction of a 1 story, 100 x 120 ft. garage at 3401-11 Cottage Grove Ave. for W. B. Frankenstein, c/o Architect. Estimated cost $75,000.

Ill., Madison—The Amer. Car & Fdry. Co., Jeffersonville, Ind., plans to build a foundry, here. Estimated cost $85,000.

Ill., Quincy—The Michaelman Steel Co. awarded the contract for the construction of a 3 and 4 story steel foundry and warehouse. Estimated cost $100,000.

Me., Portland — E. W. Jones, Exchange St., is having plans prepared for the construction of a 1 story, 100 x 180 ft. garage on Forest Ave. Estimated cost $50,000. Webster & Libby, Exchange St., Archts.

Md., Baltimore — G. Esselman, 3225 Greenmount Ave., is having plans prepared and will soon receive bids for the construction of a 2 story, 75 x 110 ft. garage at 3313-31 Greenmount Ave. Estimated cost $40,000. Private plans.

Md., Baltimore — Maryland Penitentiary, c/o C. B. Sweezy, Warden, Eager and Forrest Sts., is having plans prepared for the construction of a 1 story, 100 x 230 ft. foundry. Estimated cost $100,000. H. Massart, 328 North Charles St., Engr. T. W. Pietsch, Amer. Bldg., Archt.

Mass., Boston—The W. J. Connell Co., 574 Commonwealth Ave., awarded the contract for the construction of a 1 story, 50 x 105 ft. garage on Brookline and Burlington Aves. Cost will exceed $40,000.

Mich., Detroit—Buhl Sons, foot of Adair St., awarded the contract for the construction of a 1 story, 132 x 180 ft. garage on Wright and River Sts. Estimated cost $55,000.

Mich., Detroit—The Capitol Brass Co., 2306 Franklin St., will soon award the contract for the construction of a 3 story, 60 x 150 ft. brass factory. Estimated cost $100,000. Raseman & Freier, 1302 Penobscot Bldg., Detroit, Archts.

Mich., Detroit—C. H. Koeber, 200 McLean Ave., is having plans prepared for the construction of a 1 story, 100 x 200 ft. garage on Woodward Ave. and Stevens St. Estimated cost $50,000. S. E. Remey, 1140 Griswold St., Detroit, Archt.

Mich., Detroit—The Michigan Stamping Co., 11631 Mack Ave., awarded the contract for the construction of a 1 and 2 story, 50 x 100 ft. addition to its sheet metal stamping plant on Hart Ave. Estimated cost $75,000. Noted Oct. 25.

Minn., St. Paul—The Ford Motor Co., Highland Park (Detroit P. O.), Mich., awarded the contract for the construction of a 1 story, 606 x 1,726 ft., assembly plant, here. Noted Oct. 18.

Mo., St. Louis—The Green Fdry. Co., 3003 North Bway., awarded the contract for the construction of a 1 and 2 story, 215 x 530 ft. car wheel foundry on Kingshighway. Estimated cost $100,000.

N. J., Paterson—The Alexander Hamilton Garage Co., Inc., awarded the contract for the construction of a 4 story garage, to contain 100,000 sq.ft. of floor space.

N. Y., Geneva—The O'Malley Motor Co., 347 Exchange St., plans to rebuild its garage, to replace the one which was destroyed by fire. Estimated cost $100,000.

N. Y., Ogdensburg—The Hull Steel Fdrys. Co., Hull, Que., manufacturer of railroad equipment, is having plans prepared for the construction of a steel mill, including a 100 x 600 ft. main building, pattern department, machine shop, etc., here. Estimated cost $1,000,000. A. H. Coplan, Pres. Private plans.

N. Y., Peekskill—The Union Stove Wks. plans to rebuild its plant, to replace the one which was destroyed by fire. Estimated cost $500,000.

O., Cincinnati—H. Belmer Co., 1051 Overlook Ave.—hoisting and conveying equipment for proposed $60,000 warehouse.

O., Cleveland—The Cleveland Cutter & Reamer Co., 1619 Merwin Ave., awarded the contract for the construction of a 1 story, 40 x 100 ft. factory, at 7406 Madison Ave. Estimated cost $40,000. M. Dormer. Pres.

O., Cleveland—The Park Battery Co., 277 East 156th St., awarded the contract for the construction of a 2 story, 79 x 152 ft. garage and factory. Estimated cost $75,000.

O., Cleveland—B. Ris (metals), c/o A. N. Ferguson, Archt., 12821 Phillips Ave., awarded the contract for the construction of a 2 story, 40 x 156 ft. factory at 3035 St. Clair Ave. Estimated cost $60,000. Noted Oct. 25.

O., Cleveland—The White Motor Co., 824 East 79th St., awarded the contract for the construction of a 1 story, 100 x 100 ft. factory. Estimated cost $60,000. Noted Oct. 25.

Wis., Milwaukee—The Modern Auto Repair Co., 2431 State St., awarded the contract for the construction of a 1 story, 112 x 125 ft. addition to its garage. Estimated cost $55,000. Noted July 12.

Wis., North Milwaukee—The North Milwaukee Fdry. Co., Commerce Ave., awarded the contract for the construction of a 1 story, 65 x 100 ft. addition to its foundry. Estimated cost $40,000. Noted Oct. 4.

Ont., Welland—Gram Bros. plan to build a 2 story garage and service station on East Main and Burgar Sts. Estimated cost $40,000.

Que., Outremont—The J. O. Villeneuve Co., St. James St., plans to build a 90 x 167 ft. garage on Bernard and De L'Eppee Sts. Estimated cost $150,000.